Intel® Embedded Media and Graphics Driver v1.18 (Windows* 7 and Windows* Embedded Standard 7 Release)

User Guide

April 2013

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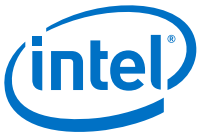

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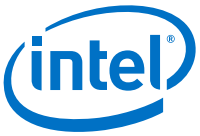

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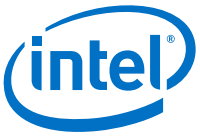


Revision History

This document may have been updated since the release shown below. See http://edc.intel.com/Software/Downloads/ for the most recent version.

Date	Revision	Description
April 2013	012	Updated for use with version 1.18 of the product.
March 2013	011	Updated for use with Preliminary version 1.18 of the product.
February 2013	010	Updated for use with Preliminary version 1.18 of the product.
October 2012	009	Updated for use with version 1.16 of the product.
September 2012	008	Updated for use with Preliminary version 1.16 of the product.
April 2012	007	Updated for use with version 1.14 of the product.
March 2012	006	Updated for use with Preliminary version 1.14 of the product.
November 2011	005	Updated for use with version 1.10 of the product.
September 2011	004	Updated for use with version 1.8.2 of the product.
June 2011	003	Updated for use with version 1.8 of the product.
May 2011	002	Beta release
March 2011	001	Alpha release

§ §

1.0 Introduction

The Intel® Embedded Media and Graphics Driver (Intel® EMGD) comprises a suite of multi-platform graphics drivers designed to meet the requirements of embedded applications. Featuring Intel® Dynamic Display Configuration Technology (DDCT), the drivers run on the following Embedded Intel® Architecture (eIA) chipsets:

- Intel® Atom™ Processor E6xx

Note: Intel® EMGD for Windows* 7 and Windows* Embedded Standard 7 supports only Intel® Atom™ Processor E6xx 1.0 GHz and above SKUs, they are 1.0 GHz (E640, E640T), 1.3 GHz (E660, E660T) and 1.6 GHz (E680, E680T). The 0.6 GHz (E620, E620T) SKU is not supported due to Microsoft Windows* 7 minimum system requirement of 1 GHz 32-bit (x86) processor or above.

- Intel® System Controller Hub US15W/US15WP/WPT chipset

Note: If you need support for a chipset that is not listed above but is in the same family as those listed, please contact your Intel representative.

The Intel® Embedded Media and Graphics Driver supports the following types of display devices:

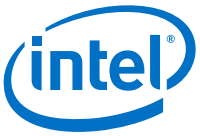
- Analog CRT (through sDVO)
- LVDS flat panels (for both internal and external LVDS)
- TMDS DVI displays (through sDVO)
- HDMI (through sDVO)
- TV Output (through sDVO)

Intel® EMGD is designed to work with fixed-function systems, such as Point-of-Sale (POS) devices, ATMs, gaming devices, In-vehicle Information/Entertainment systems, etc. It can be configured to work with various hardware and software systems and supports Microsoft Windows* operating systems, including embedded versions of these operating systems.

Intel® EMGD contains a Video BIOS (VBIOS) component. Both Intel® EMGD and the VBIOS component are configurable and work together to provide a wide range of features. This document provides information on configuring and using both the Intel® EMGD and the VBIOS.

1.1 Purpose

This manual provides information on both firmware and software, providing hardware design considerations, installation requirements, and static configuration options.



1.2 Intended Audience

This document is targeted at all platform and system developers who need to interface with the graphics subsystem. This includes, but is not limited to: platform designers, system BIOS developers, system integrators, original equipment manufacturers, system control application developers, as well as end users.

1.3 Related Documents

The following documents provide additional information that may be useful when using the Intel® Embedded Media and Graphics Driver. Additional resources are available at http://edc.intel.com/Software/Downloads/EMGD/.

- *Intel® Atom™ Processor E6xx B0 Silicon Erratum #9: Clipped SDVO Display on Dual Displays or Sprite Plane-Enabled SDVO Display Frequently Asked Questions*
  (Document Number: 455133)
- *Display Flickering Sightings and Characterization on Intel® Atom™ Processor E6xx Series (B0-Stepping) White Paper*
  (Document Number: 324737)
- *Intel® Embedded Graphics Drivers for Embedded Intel® Architecture-based Chipsets Product Brief*
  (Document Number: 315587)
- *Intel® Atom™ Processor Z5xx Series Datasheet*
  (Document Number: 319535)
- *Intel® System Controller Hub (Intel® SCH) Datasheet*
  (Document Number:319537)
- *Intel® I/O Controller Hub 9 (ICH9) Family Datasheet*
  (Document Number:316972)
- *Integrated Dual Independent Display on Intel® Digital Security Surveillance Multifunction Platforms Application Brief*
- *Display Panel Debugging with the Intel Graphics Memory Controller Hub*
  (Document Number: 305964)
- *VESA BIOS Extensions/Display Data Channel Standard*
  This document provides information on the 4F VBE functions, which are supported by the Intel embedded Video BIOS.
- *VESA BIOS Extension (VBE) Core Functions Standard Version 3.0*
  Contains information on the VESA BIOS Extension (VBE) specification for standard software access to graphics display controllers that support resolutions, color depths, and framebuffer organizations beyond the VGA hardware standard.

Note: The above two documents are available from http://www.vesa.org. Membership may be required to access these documents. Reproductions may also be available from elsewhere on the Internet.

1.4 Conventions

The following conventions are used throughout this document.

Boldface	Represents text that you type and text that appears on a screen.
Italics	Introduces new terms and titles of documents.
`Courier New`	Identifies the names of files, executable program names, and text that appears in a file.
Angle Brackets (< >)	Encloses variable values in syntax or value ranges that you must replace with actual values.
Vertical Bar (|)	Used to separate choices (for example, TRUE | FALSE)

1.5 Acronyms and Terminology

The table below lists the acronyms and terminology used throughout this document.

Table 1. Acronyms and Terminology (Sheet 1 of 4)

Term	Description
ADD Card	AGP Digital Display. An adapter card that can be inserted into the PCIe x16 port of Intel chipset family-based systems. ADD cards allow configurations for TV-out, LVDS, and TMDS output (i.e., televisions, digital displays, and flat panel displays).
AIM	Add In Module.
API	Application Programming Interface.
BDA	BIOS Data Area. A storage area that contains information about the current state of a display, including mode number, number of columns, cursor position, etc.
BIOS	Basic Input/Output System. The Intel® Embedded Media and Graphics Driver interacts with two BIOS systems: system BIOS and Video BIOS (VBIOS). VBIOS is a component of the system BIOS.
BLDK	Boot Loader Development Kit.
CED	Configuration EDitor. Graphical pre-installation utility allows easy creation of consolidated driver installation packages for Windows* operating systems, and VBIOS across numerous platforms and display combinations.
Clone Display Configuration	A type of display configuration that drives two display devices, each displaying the same content, but can have different resolutions and (independent) timings. Compare Twin Display Configuration and DIH Display Configuration.
Contrast Ratio	Contrast ratio is the measure of the difference between light and dark on a display. If the contrast is increased, the difference between light and dark is increased. So something white will be very bright and something black will be very dark. Brightness and Contrast Controls differ in function between CRTs and LCDs.
COPP	Certified Output Protection Protocol* is a Microsoft-defined API to provide application with information about what output protection options are available on a system.
D3D	Microsoft Direct3D*. A3D graphics API as a component of DirectX* technology.
DC	Display Configuration.
DDCT	Intel® Dynamic Display Configuration Technology.
DirectDraw*	A component of the DirectX* Graphics API in Microsoft Windows OS.

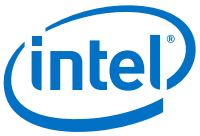


Table 1. Acronyms and Terminology (Sheet 2 of 4)

Term	Description
DIH Display Configuration	Dual Independent Head. A type of display configuration that supports two displays with different content on each display device. The Intel® Embedded Media and Graphics Driver supports Extended mode for Microsoft Windows systems.
DTD	Detailed Timing Descriptor. A set of timing values used for EDID-less devices.
DVI	Digital Video Interface.
DVO	Digital Video Output.
EBDA	Extended BIOS Data Area. An interface that allows the system BIOS and Option ROMs to request access to additional memory.
EDID	Extended Display Identification Data. A VESA standard that allows the display device to send identification and capabilities information to the Intel® Embedded Media and Graphics Driver. Intel® EMGD reads all EDID data, including resolution and timing data, from the display, thus negating the need for configuring DTD data for the device.
EDID-less	A display that does not have the capability to send identification and timing information to the driver and requires DTD information to be defined in the driver.
eIA	Embedded Intel® Architecture.
EVR	Enhanced Video Renderer
Extended Clone Mode	A feature that allows you to have different sized displays in Clone mode.
Framebuffer	A region of physical memory used to store and render graphics to a display.
GDI	Graphics Device Interface. A low-level API used with Microsoft Windows operating systems.
GMA	Intel Graphics Media Accelerator. Refers to both the graphic hardware in Intel chipsets as well as the desktop/mobile driver. The GMA driver is not intended for use in embedded applications.
GMS	Graphics Mode Select (stolen memory).
HAL	Hardware Abstraction Layer. An API that allows access to the Intel® chipsets.
HDCP	High-bandwidth Digital-Content Protection. A specification that uses the DVI interface. HDCP encrypts the transmission of digital content between the video source (transmitter) and the digital display (receiver).
HDMI	High-Definition Multimedia Interface, an uncompressed, all-digital, audio/video interface.
iDCT	Inverse Discrete Cosine Transform (hardware feature).
INF file	A standard Microsoft Windows text file, referred to as an information file, used by Microsoft Windows OS to provide information to the driver. The default .inf file for the Intel® Embedded Media and Graphics Driver is `igdlh32.inf`. You can create customized parameters using the CED utility.
LPCM	Linear Pulse Code Modulation. A method of encoding audio information digitally. The term also refers collectively to formats using this method of encoding.
LVDS	Low Voltage Differential Signaling. Used with flat panel displays, such as a laptop computer display.
NTSC	National Television Standards Committee. An analog TV standard used primarily in North and Central America, Japan, the Philippines, South Korea, and Taiwan. Its resolutions are based on 525-line systems. Compare PAL.
Option ROM (OROM)	Code that is integrated with the system BIOS and resides on a flash chip on the motherboard. The Intel Embedded Video BIOS is an example of an option ROM.

Table 1. Acronyms and Terminology (Sheet 3 of 4)

Term	Description
OS	Operating System.
PAL	Phase Alternating Lines. An analog TV standard used in Europe, South America, Africa, and Australia. Its resolutions are based on 625-line systems. Compare NTSC.
PCF	Parameters Configuration File.
PCI	Peripheral Component Interface.
Port Driver	A driver used with the sDVO interfaces of the System Controller Hub (SCH).
POST	Power On Self Test.
PWM	Pulse Width Modulation.
Saturation	Monitors and scanners are based on the “additive” color system using RGB, starting with black and then adding Red, Green, and Blue to achieve color. Saturation is the colorfulness of an area judged in proportion to its brightness. Full saturation of RGB gives the perception of white, and images are created that radiate varying amounts of RGB, or varying saturation of RGB.
SCART	French Acronym - Syndicat des Constructeurs d'Appareils Radiorecepterus et Televiseurs. A video interface possessing up to four analog signals (Red/Green/Blue/Composite PAL). S-Video (Luma/ Chroma) is possible over the SCART interface as well.
SCH	System Controller Hub.
SCS	Software Compliance Statement.
sDVO	Serial Digital Video Output.
Single Display Configuration	A type of display configuration that supports one and only one display device.
SSC	Spread Spectrum Clock.
Stolen Memory	A region of physical memory (RAM) set aside by the system BIOS for input and output operations. The amount of stolen memory is configurable. Stolen memory is not accessible to the operating system or applications.
System BIOS	The standard BIOS used for basic input and output operations on PCs.
TMDS	Transitioned Minimized Differential Signaling. Used with DVI displays, such as plasma TVs.
TOM	Top Of Memory.
TSR	Terminate and Stay Resident. A program that is loaded and executes in RAM, but when it terminates, the program stays resident in memory and can be executed again immediately without being reloaded into memory.
Twin Display Configuration	A type of display configuration that supports two display devices each of which has the same content, resolution, and timings. Compare Clone Display Configuration. Note: Twin configuration is not supported on US15W series chipsets.
VBIOS	Video Basic Input Output System. A component of system BIOS that drives graphics input and output.
VESA	Video Electronics Standards Organization.
VGA	Video Graphics Array. A graphics display standard developed by IBM* that uses analog signals rather than digital signals.

Table 1. Acronyms and Terminology (Sheet 4 of 4)

Term	Description
VLD	Variable Length Decode.
WHQL	Windows* Hardware Quality Labs. WHQL is a testing organization responsible for certifying the quality of Windows drivers and hardware that runs on Windows operating systems.
YUV	Informal, but imprecise reference to the video image format, Y'CbCr. The Y' component is luma, a nonlinear video quality derived from RGB data denoted without color. The chroma components, Cb and Cr, correspond nonlinearly with U and V as differences between the blue and luma, and between the red and luma, respectively.

1.6 Downloading Intel® EMGD and Video BIOS

Download Intel® EMGD and the Video BIOS (VBIOS) from one of the following locations:

- From the Intel Embedded Design Center (http://www.intel.com/p/en_US/embedded/hwsw/software/emgd#download) only, where the following is available:

  Intel Embedded Media and Graphics Driver Configuration Editor (CED) release

  — includes the Intel® EMGD drivers for VBIOS and all Windows* operating systems, plus an embedded help system

  — currently runs only on Windows operating systems.
- From the QuAD system: Intel Premier Support (QuAD) (https://premier.intel.com)
- From the new IPS system: https://businessportal.intel.com. You will be redirected to: https://welcome.intel.com/login.aspx where you will need to log in.

  Click on the **Product Support** tab.

  Note: DO NOT use the **Design & Technology** tab, which takes you to the old IPS system.

Note: The latest version of embedded Video BIOS is recommended for use with each of the graphics drivers in most cases. Click the following link to see the FAQ page for details on the differences of these versions.
http://edc.intel.com/Software/Downloads/EMGD/#faqs

After you have downloaded, installed, and run CED, you can configure and customize the drivers and VBIOS following the procedures in this document. After they have been configured, you can integrate the VBIOS with the system BIOS ROM and install Intel® EMGD on your operating system.

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2.0 Architectural Overview

2.1 Introduction

The Intel® Embedded Media and Graphics Driver is composed of a runtime graphics driver and a Video BIOS (VBIOS) firmware component. (See the illustrations below.) Both the driver and VBIOS control the SCH to perform display and render operations. The VBIOS is predominantly leveraged by System BIOS during system boot but is also used at runtime by the driver to handle full-screen text mode on Microsoft Windows* operating systems.

Figure 1. Intel® Embedded Media and Graphics Driver

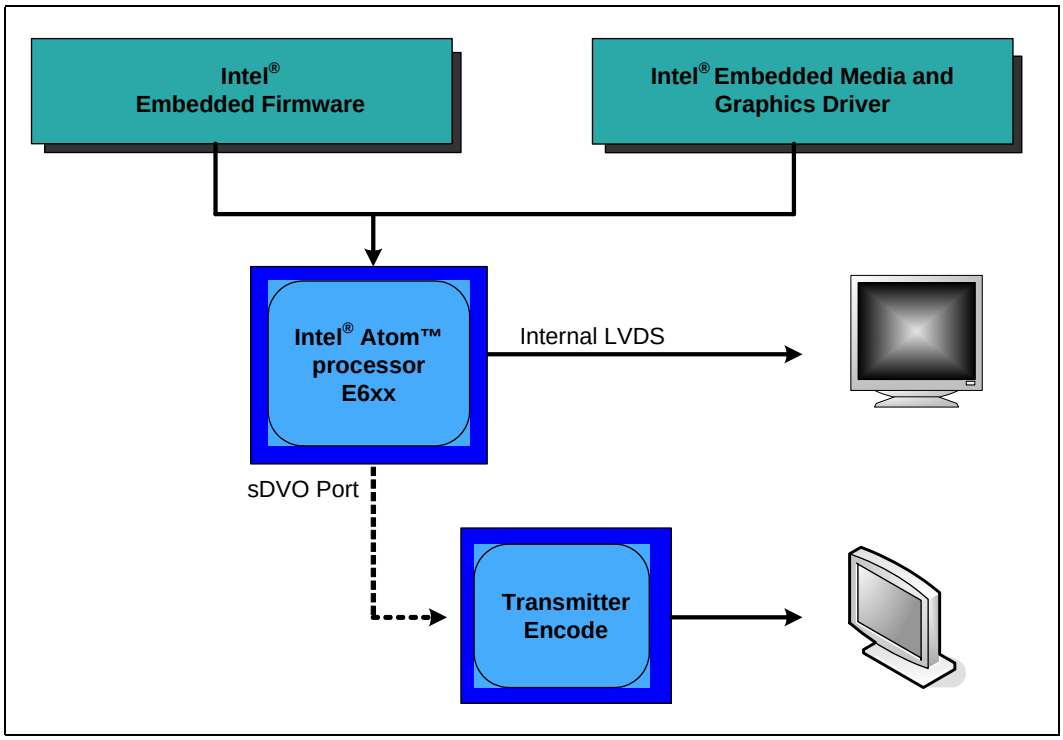


Figure 2. Graphics Driver Architecture

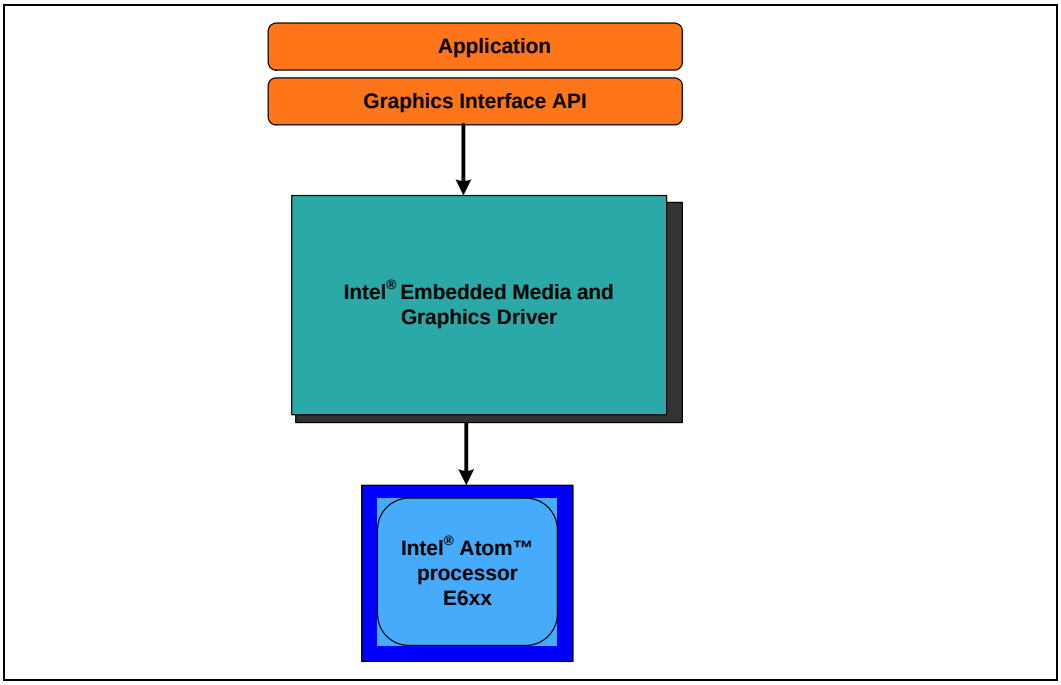
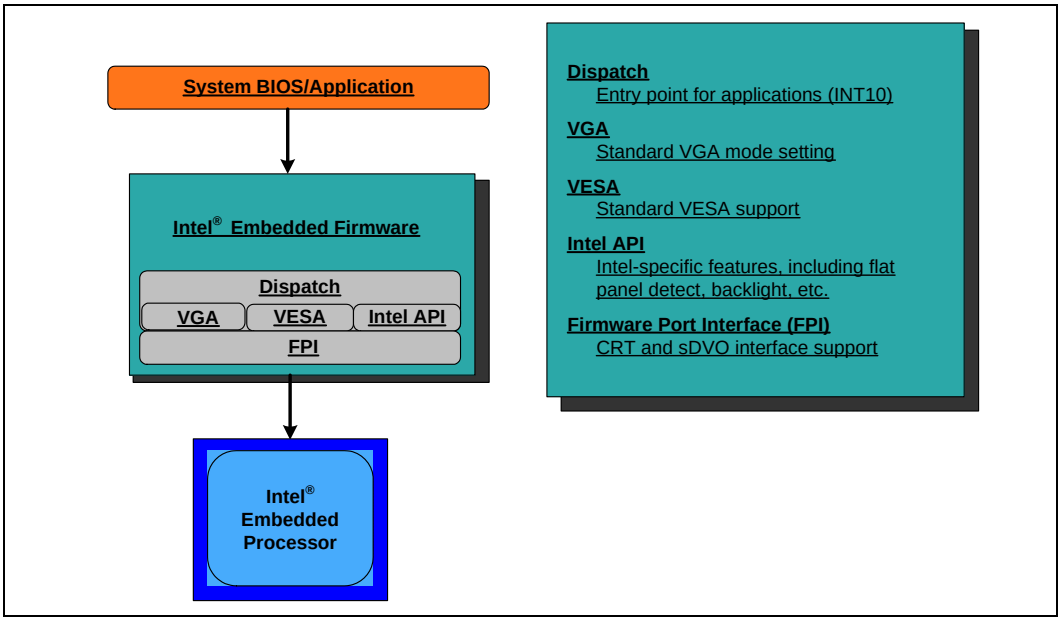


Figure 3. Firmware Architecture



2.1.1 Display Options

The following section describes the types of displays and configurations supported by the Intel® Embedded Media and Graphics Driver.

2.1.1.1 Types of Displays

The table below lists the types of displays supported by the Intel® Embedded Media and Graphics Driver.

Table 2. Types of Displays Supported

Display	Description
CRT	Analog CRT, supported with an external transmitter via an sDVO port.
Flat Panel	TMDS and LVDS compliant flat panels are supported with the use of an external transmitter via an sDVO port. Integrated LVDS flat panels are also natively supported on the Intel® System Controller Hub US15W/US15WP/WPT chipset and Intel® Atom™ Processor E6xx.
TV	TV-out is supported via an external encoder sDVO port.

2.1.1.2 Display Configuration

Intel® EMGD supports driving two displays simultaneously. Several configurations are supported, dependent on operating system and chipset. The various display configurations are described in the table below.

Table 3. Display Configuration Definitions

Display Configuration Mode	Description
Single	Normal desktop configuration, single monitor
Clone†	Two displays, same content, different resolutions, independent timings
Extended†	Two displays, continuous content (available in Windows only)
† Supported display depends on driver and hardware availability. See the RelNotes.txt for more information.	

The table below summarizes which display configurations are supported by Intel chipsets.

Table 4. Supported Display Configurations

Chipset	Operating System
	Windows* 7 and Windows Embedded Standard* 7
Intel® Atom™ Processor E6xx	Single, Clone, Extended ***Note:*** Depends on driver and hardware availability.
Intel® US15W/US15WP/WPT	Single, Clone, Extended

Intel® EMGD supports Clone mode through custom APIs. In contrast, Microsoft Windows natively supports Extended and DIH.

2.2 Features

The following sections describe major features Intel® EMGD supports.

2.2.1 Chipsets Supported

The table below lists Intel® EMGD-supported chipsets.

Table 5. Chipsets Supported by the Intel® EMGD

Chipset	Intel® EMGD VBIOS Support	Intel® EMGD Support
Intel® Atom™ Processor E6xx	Yes	Yes
Intel® System Controller Hub US15W/US15WP/WPT chipset	Yes	Yes

All supported chipsets provide for SINGLE LVDS output. In addition, digital monitors, CRTs and TVs are supported through the US15W/US15WP/WPT and MCH/Intel® Atom™ Processor E6xx sDVO interfaces, depending on hardware availability.

2.2.2 OS and API Support

The Intel® Embedded Media and Graphics Driver and Video BIOS support the following operating systems and APIs.

- Microsoft Windows* 7 Professional
- Microsoft Windows* 7 Ultimate
- Microsoft Windows* Embedded Standard 7
- DirectX* 9.0Ex
- DirectX* Video Acceleration (DXVA) 2.0
- Intel® Media SDK 2.0
- OpenGL 2.0

2.2.3 EDID-Less Configuration

EDID-less support is the ability to run a display panel that does not have display timing information within the panel. Therefore, the user has to provide the display timing information to the graphics drivers during configuration using CED. See "Creating a New Customized DTD" on page 20.

This document describes only the necessary edits to the configuration files that are required to implement the graphics driver and VBIOS, and not specific settings for EDID-less panel configuration. Please refer to the manufacturer's specifications for the DTD settings to use for your EDID-less panels.

2.2.3.1 EDID-Less Panel Type Detection

The Intel® Embedded Media and Graphics Driver supports EDID-less displays that do not export timing modes. This is accomplished by allowing configuration of a Detailed Timing Descriptor (DTD), and associating that DTD with a specific display port.

2.2.4 Rotation

Rotation is the ability to rotate the display for the Intel® Embedded Media and Graphics Driver. Rotation support includes 0°, 90°, 180°, 270°. Rotation is supported only on the following chipsets:

- Intel® Atom™ Processor E6xx
- Intel® System Controller Hub US15W/US15WP/WPT chipset

Note: Rotation is not supported with the VBIOS.

§ §

3.0 Platform Configuration Using CED

The Intel® EMGD Configuration Editor (CED) is a Windows-based Graphical User Interface (GUI) that allows you to create configurations, package the configurations, and create installations that can be loaded directly on a specific OS or Video BIOS platform. Configurations are associated with a specific chipset and can be created for any one of the following supported chipsets:

- Intel® Atom™ Processor E6xx
- Intel® System Controller Hub US15W/US15WP/WPT chipset

CED runs on both Windows* 7 32-bit and 64-bit environments.

The CED GUI is designed for ease of use and configuration of the Intel® EMGD. Each configuration page has online help available and each data field is validated. If you enter an incorrect value, CED displays an error message at the top of the page and displays the valid range of values for the field. You cannot finish a configuration until all fields contain valid values.

The following sections show how to create a configuration for any of the supported chipsets, operating systems, and the Intel® EMGD Video BIOS.

- "Starting CED" on page 20
- "Creating a New Customized DTD" on page 20
- "Creating a New Configuration" on page 24
- "Creating a New Package" on page 36
- "Generating an Installation" on page 38

3.1 Before You Begin

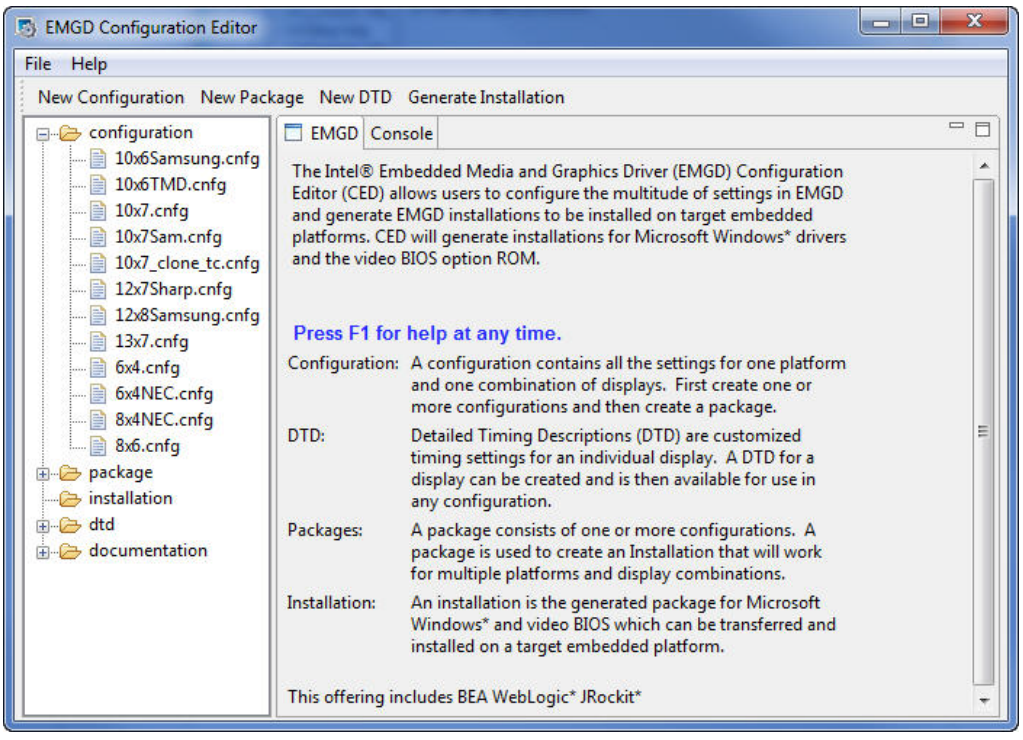
To configure the Intel® EMGD software using CED, you will need some information on the panel you are using. This information is usually found in the product specifications. In some cases the terminology used in CED may not match the labels used in your panel's product specification. Refer to Table 7, "Timing Specification Example Values" on page 23 for hints on which specs correspond to CED Detailed Timings Descriptor (DTD) fields. After you obtain the correct specification values, you may need to derive other values for the DTD fields.

3.2 Creating a Configuration in CED – Summary Steps

The following steps present a sample CED configuration.

1. (Optional) If you have custom panels and timings you may want to create your own DTD; otherwise you can use the standard DTDs provided by CED. If needed, select **New DTD**.
   - Choose the DTD Type that most closely aligns with your display parameters, enter parameters, and then click **Finish**. Or, to create a DTD, see "Creating a New Customized DTD" on page 20.
2. Select **New Configuration**.
   - Enter a name for the configuration, select the mode, chipset, ports, port drivers, DTDs, etc., for the configuration and then click **Finish**. For details, see "Creating a New Configuration" on page 24.
3. Select **New Package**.
   - Enter a name for the package, select the configurations for your package, the platforms for the installation, and then click **Finish**. For details, see "Creating a New Package" on page 36.
4. Select the created package and then select **Generate Installation**.
   The generated files are placed in the installation folder. The zip files contain the generated configuration files. For details, see "Generating an Installation" on page 38.

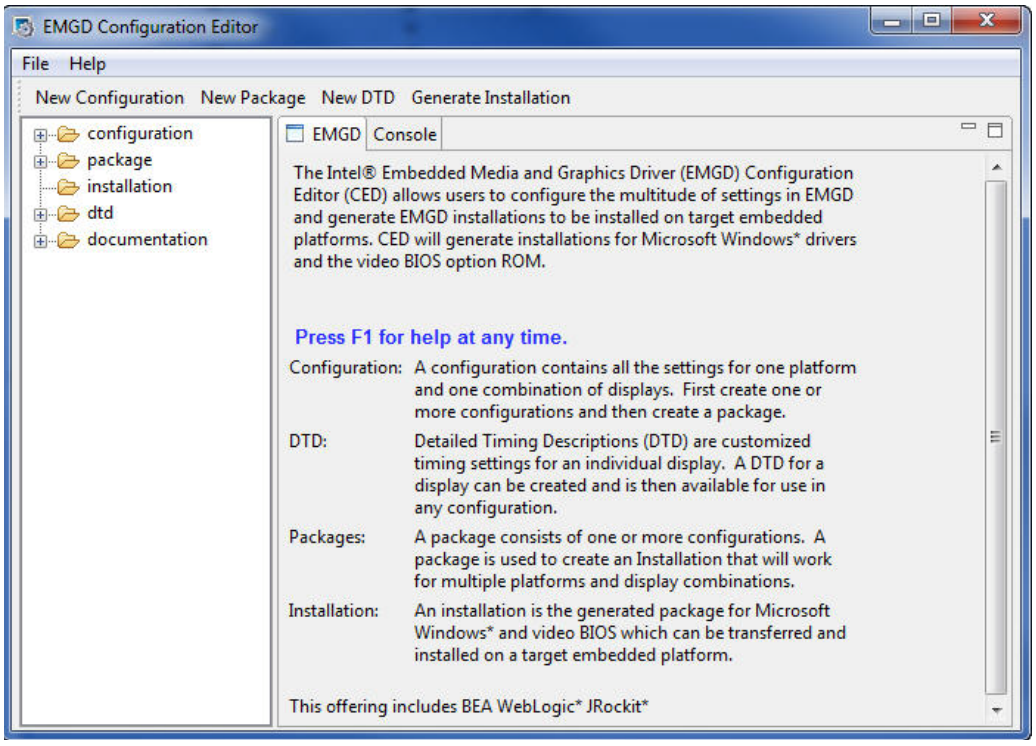
Figure 4. Sample CED Configuration Start Page


EMGD Configuration Editor
File Help
New Configuration New Package New DTD Generate Installation
configuration
10x6Samsung.cnfg
10x6TMD.cnfg
10x7.cnfg
10x7Sam.cnfg
10x7_clone_tc.cnfg
12x7Sharp.cnfg
12x8Samsung.cnfg
13x7.cnfg
6x4.cnfg
6x4NEC.cnfg
8x4NEC.cnfg
8x6.cnfg
package
installation
dtd
documentation
EMGD Console
The Intel® Embedded Media and Graphics Driver (EMGD) Configuration Editor (CED) allows users to configure the multitude of settings in EMGD and generate EMGD installations to be installed on target embedded platforms. CED will generate installations for Microsoft Windows* drivers and the video BIOS option ROM.
Press F1 for help at any time.
Configuration: A configuration contains all the settings for one platform and one combination of displays. First create one or more configurations and then create a package.
DTD: Detailed Timing Descriptions (DTD) are customized timing settings for an individual display. A DTD for a display can be created and is then available for use in any configuration.
Packages: A package consists of one or more configurations. A package is used to create an Installation that will work for multiple platforms and display combinations.
Installation: An installation is the generated package for Microsoft Windows* and video BIOS which can be transferred and installed on a target embedded platform.
This offering includes BEA WebLogic* JRockit*

3.3 Starting CED

To start the Intel® EMGD CED, open the folder where you installed CED and click the `emgd-ced.exe` icon. The Intel® EMGD CED splash window appears for a few moments followed by the Intel® EMGD Configuration Editor main window.

Figure 5. Intel® EMGD Configuration Editor Main Window


EMGD Configuration Editor
File Help
New Configuration New Package New DTD Generate Installation
configuration
package
installation
dtd
documentation
EMGD Console
The Intel® Embedded Media and Graphics Driver (EMGD) Configuration Editor (CED) allows users to configure the multitude of settings in EMGD and generate EMGD installations to be installed on target embedded platforms. CED will generate installations for Microsoft Windows* drivers and the video BIOS option ROM.
Press F1 for help at any time.
Configuration: A configuration contains all the settings for one platform and one combination of displays. First create one or more configurations and then create a package.
DTD: Detailed Timing Descriptions (DTD) are customized timing settings for an individual display. A DTD for a display can be created and is then available for use in any configuration.
Packages: A package consists of one or more configurations. A package is used to create an Installation that will work for multiple platforms and display combinations.
Installation: An installation is the generated package for Microsoft Windows* and video BIOS which can be transferred and installed on a target embedded platform.
This offering includes BEA WebLogic* JRockit*

From this window, you can create configurations, package the configurations, and create installations from the packages that can be installed directly on a platform. The main window also provides a Console tab that displays information when you build a package or an installation.

The following sections show how to create a configuration for any of the supported chipsets, operating systems, and the Intel® EMGD Video BIOS.

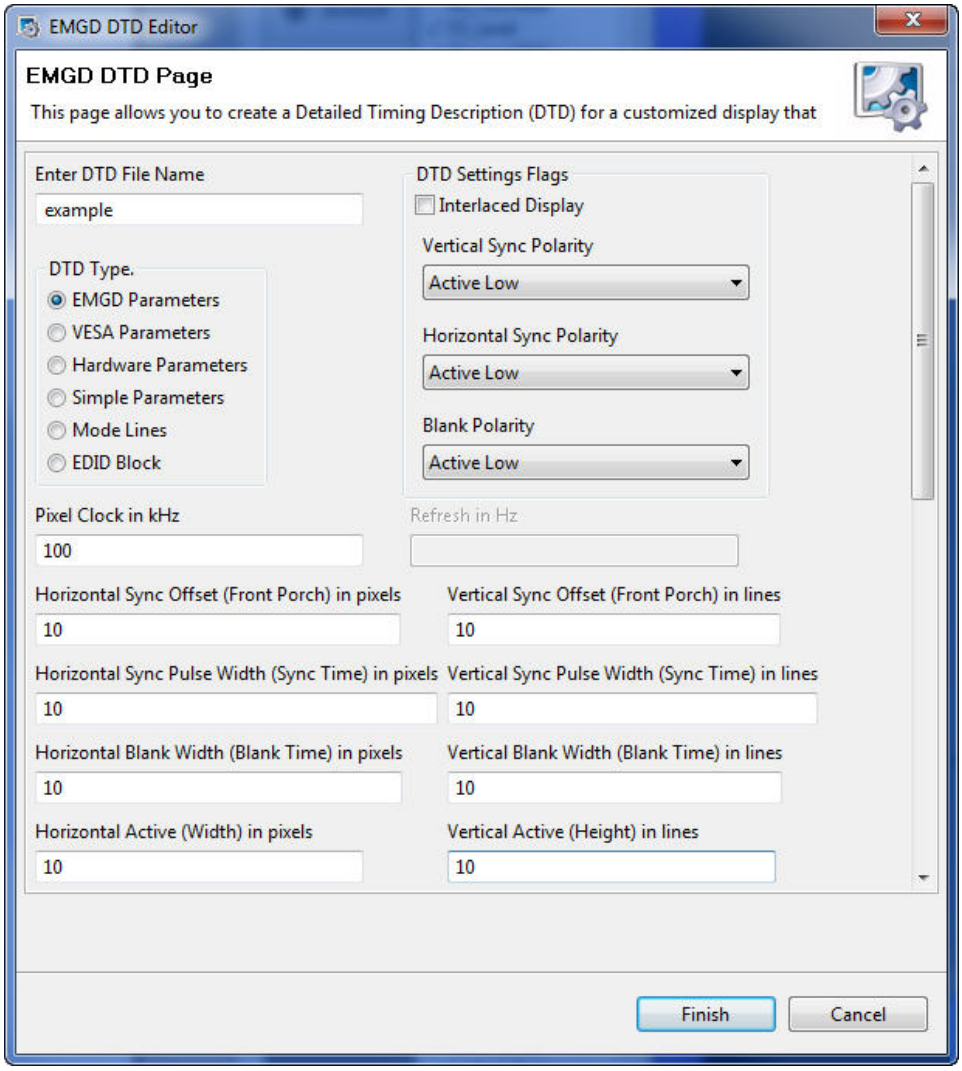
3.4 Creating a New Customized DTD

CED allows you to create Dynamic Timings Definitions (DTD) for EDID-less displays or displays for which you do not want to use the display's EDID settings. In either of those cases, you can create your own DTD using the steps below. Otherwise you can use one of the standard DTDs included in CED.

You can create a new DTD by clicking the **New DTD** link at the top of the main CED window, or you can create DTDs for each configured port when you create a new configuration. Any DTDs you create will be available for all configurations.

When you select **New DTD** from the main CED window, the following Intel® EMGD DTD Page appears.

Figure 6. EMGD DTD Page



To create a custom DTD setting:

1. From the CED main screen, select **New DTD**.
2. Enter a name for the DTD in the text box provided, for example, *test_LVDS*.
3. Using the data sheet from the panel being used, enter the DTD timings in the appropriate fields. Refer to Table 6, "Intel® EMGD DTD Setting Options" for field descriptions.
   The screen will be similar to the example shown in Figure 6.
4. Click **Finish**.
   The custom DTD is complete.

Table 6. Intel® EMGD DTD Setting Options (Sheet 1 of 2)

DTD Parameter	Description
Enter DTD File Name	Enter a name for this customized DTD. This is a required field and the name must be between 1 and 50 characters and may contain spaces and underscores.
DTD Type	Select the DTD Type that most closely aligns with your display parameters. Options are: • Intel® EMGD **Parameters**: The Intel® EMGD Parameters are the same as the current PCF/CED DTD parameters. • **VESA Parameters**: The VESA Parameters allow the user to create a DTD from a VESA monitor timing standard. • **Hardware Parameters**: The Hardware Parameters are the parameters that are used by Intel® EMGD. • **Simple Parameters**: The Simple Parameters (CVT Standard) is a process for computing standard timing specifications. The method for developing Reduced Blanking timings is not included. • **Mode Lines**: The Mode Lines are a video timing spec used by X.Org. The X.Org timing setting for Mode Lines is “name” I A B C D E F G H. For example: “640x480@8bpp” 25.175 640 672 728 816 480 489 501 526. • **EDID Block**: The EDID Block is the detailed timing section (18 bytes) of the basic 128-byte EDID data structure. The detailed timing section starts at 36h of the 128-byte EDID data structure. Enter the EDID block 1 byte at a time. Example: a0 0f 20 00 31 58 1c 20 d2 1a 14 00 f6 b8 00 00 00 18
Pixel Clock	Pixel clock value in KHz. Range 0-1000000.
DTD Settings Flags	This section allows you to set flags for Interlace, Vertical Sync Polarity, Horizontal Sync Polarity, and Blank Sync Polarity. Each field in this section is described below. **Interlaced Display**: • Check for Interlaced • Cleared for Non-interlaced **Vertical Sync Polarity**: • Active Low (Default) • Active High **Horizontal Sync Polarity**: • Active Low (Default) • Active High **Blank Sync Polarity**: • Active Low (Default) • Active High ***Note:*** These flags are Intel® EMGD-specific and do not correspond to VESA 3.0 flags.
Horizontal Sync Offset (Front Porch) in pixels	Specifies the amount of time after a line of the active video ends and the horizontal sync pulse starts (Horizontal Front Porch). Range 0-8191 [13 bits].
Horizontal Sync Pulse Width (Sync Time) in pixels	Width of the Horizontal Sync Pulse (Sync Time) which synchronizes the display and returns the beam to the left side of the display. Range 0-8191 [13 bits].
Horizontal Blank Width (Blank Time) in pixels	This parameter indicates the amount of time it takes to move the beam from the right side of the display to the left side of the display (Blank Time). During this time, the beam is shut off, or blanked. Range 0-32767 [15 bits].

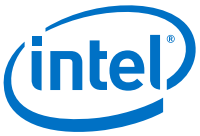


Table 6. Intel® EMGD DTD Setting Options (Sheet 2 of 2)

DTD Parameter	Description
Horizontal Active (Width) in pixels	Number of pixels displayed on a horizontal line (Width). Range 1-32767 [15 bits].
Horizontal Sync Start in pixels	This parameter specifies the start of the horizontal active time. Range 0-40957.
Horizontal Sync End in pixels	This parameter specifies the end of the horizontal active time. Range 0-49148.
Horizontal Blank Start in pixels	This parameter specifies the start of one line of the video and margin period. Range 0-32766.
Horizontal Blank End in pixels	This parameter specifies the end of one line of the video and margin period. Range 0-65533.
Refresh in Hz	Also known as the Vertical Refresh, the rate the full display updates. Standard refresh rates are 50Hz, 60Hz, 75Hz, and 85Hz.
Vertical Sync Offset (Front Porch) in lines	Specifies the amount of time after last active line of video ends and vertical sync pulse starts (Vertical Front Porch). Range 0-63 [6 bits].
Vertical Sync Pulse Width (Sync Time) in lines	Specifies the Width of the Vertical Sync Pulse which synchronizes the display on the vertical axis and returns the beam to the top, left side of the display. Range 0-63 [6 bits].
Vertical Blank Width (Blank Time) in lines	The amount of time for the complete vertical blanking operation to complete. It indicates the time it takes to move the beam from the bottom right to the top, left side of the display (Blank Time). During this time, the beam is shut off, or blanked. Range 0-4095 [12 bits].
Vertical Active (Height) in lines	The number of active lines displayed (Height). Range 1-4095 [12 bits].
Vertical Sync Start in lines	This parameter specifies the start of the vertical sync. Range 0-4157.
Vertical Sync End in lines	This parameter specifies the end of the vertical sync. Range 0-4220.
Vertical Blank Start in lines	This parameter specifies the start of display vertical blanking including margin period. Range 0-4094.
Vertical Blank End in lines	This parameter specifies the end of vertical blanking. Range 0-8189.

3.4.1 DTD Example Specifications

The following table shows example product specifications that can be used in the timing fields.

Table 7. Timing Specification Example Values (Sheet 1 of 2)

Item		Symbol	Standard value			Unit
			Min.	Typ.	Max.	
Clock	Frequency	1/ts	29.91	33.231	36.55	MHz
	Period	ts	27.36	30.06	33.43	ns
	Hi-time	tsh	7	–	–	ns
	Low-time	tsl	7	–	–	ns
	DUTY ratio	th/tl	35	50	65	ns
Data	Setup time	tds	7	–	–	ns
	Hold time	tdh	4	–	–	ns
H sync.	Period	tlpl, tlpd	24.51	31.75	32.05	us
			880	1056	1088	clk
	Pulse width	tlw	3	128	200	clk
H display	Term	thd	800	800	800	clk

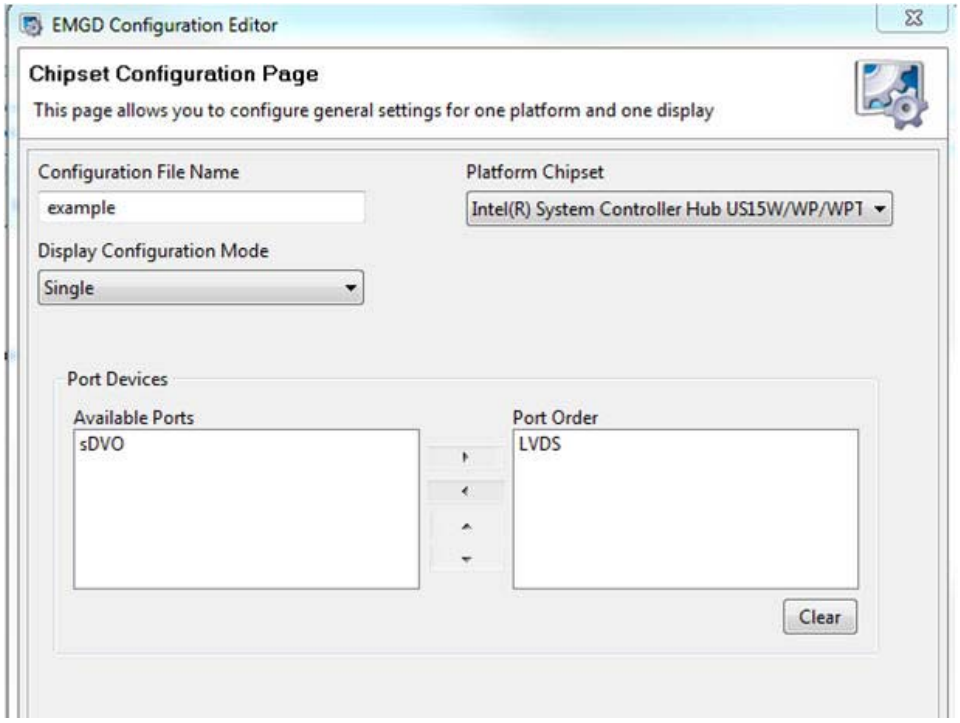
Table 7. Timing Specification Example Values (Sheet 2 of 2)

Item		Symbol	Standard value			Unit
			Min.	Typ.	Max.	
Enable	Setup time	tdrs	7	–	–	ns
	Hold time	tdrh	4	–	–	ns
V sync.	Period	tfpf, tfpd	520	525	680	Line
	Pulse width	tfw	1	2	3	Line
V display	Term	tvd	480	480	480	Line
	Start	tfd	10	33	40	Line
Phase difference	H sync. ~ enable	tdrds	50	216	260	clk
	H sync. ~ clock	tls	7	–	–	ns
	H sync. ~V sync.	tn	7	–	–	ns

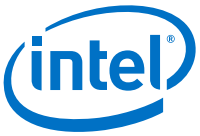
3.5 Creating a New Configuration

To create a new configuration, click the **New Configuration** selection located on the top of the Intel® EMGD CED main window. The Chipset Configuration Page appears, as shown on the next page.

Figure 7. Chipset Configuration Page



The Chipset Configuration Page allows you to specify settings that apply to Windows* 7 and Windows Embedded Standard* 7 operating systems and VBIOS platforms.



The table below describes each setting on the Chipset Configuration page.

Table 8. Chipset Configuration Page Settings

Setting	Description
Configuration File Name	Provide a name for the configuration you are creating. This name is required and is used when you create packages. The name can consist of any alphanumeric characters and any special characters and must be between 1 and 50 characters. You must enter a configuration before you can enter any other information on this page.
Platform Chipset	Select the target chipset for this configuration from the drop-down list.
Display Configuration Mode	Select the type of display configuration from the drop-down list. You can select any one of the following display configurations: • Single — Single display configuration. • Clone — Two displays where both displays have the same content but can have different resolutions and timings. • DIH — Dual Independent Head. This is a configuration where both displays can have different resolutions, different refresh rates, and different content. ***Note:*** On Microsoft Windows* DIH configurations, the display DOES NOT automatically come up in extended display mode. You must go into the Display properties on the Control Panel and manually set the display to DIH mode.
Port Devices (Available Ports, Port Order)	The Port Devices section lists the ports available based on the chipset selected. The Available Ports box lists the ports available to the chipset. You can move these port devices to the Port Order box to determine the search order for detecting attached displays. To move a port device to the Port Order box, either double-click the port device or click the port device to highlight it, and then click the right arrow button to move it from the Available Ports to the Port Order box. The Port Order section allows you to determine the search order for detecting attached displays for the Display Detection feature. When Display Detection is enabled, the Port Order determines which display is primary and which display is secondary. ***Note:*** When you move one or more ports to the Port Order box, you can configure each port by clicking **Next**. For each port listed in the Port Order box, you can click **Next** to configure each port. See "Configuring Ports" on page 27 for information on configuring ports.

3.5.1 Setting Color Correction

Color Correction is available for framebuffers, and is accessed under the **New Configuration** link at the top of the main CED window. For framebuffer color correction, user-assigned values must be between 0.6 to 6. By default, gamma is 1.0 (no correction).

3.5.1.1 Framebuffer Color Correction Attributes

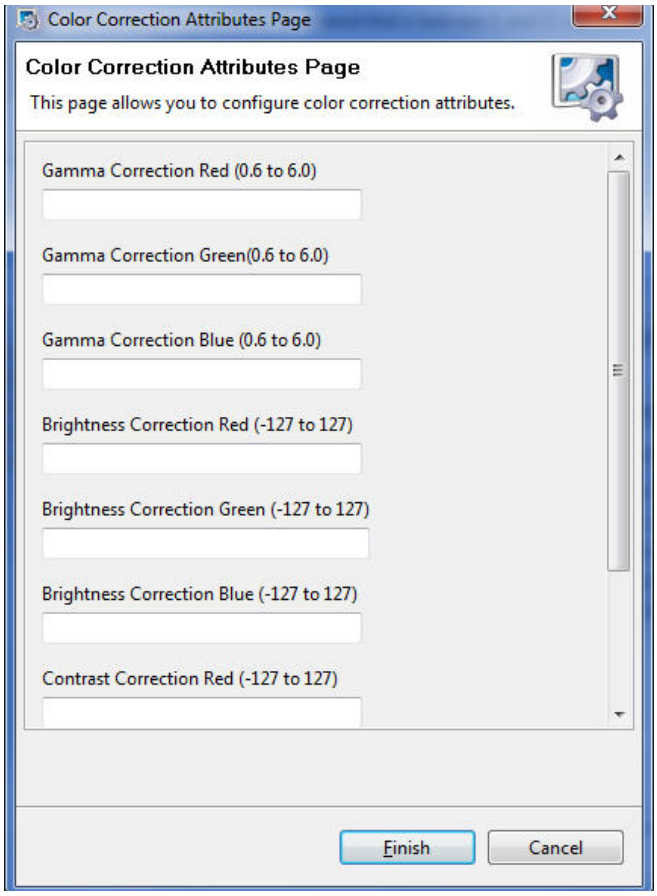
Framebuffer Color Correction Attributes lets you adjust the main color attributes. This feature allows you to color-correct for red, green, and blue, and enables you to adjust brightness and contrast.

Table 9. Framebuffer Color Correction Values (applies to R, G, B color)

Gamma:	0.6 to 6.0 (default value is 1)
Brightness:	-127 to 127 (default value is 0)
Contrast:	-127 to 127 (default value is 0)

To assign framebuffer color correction, click the **Framebuffer Color Correction Attributes** button on the port configuration page (LVDS or sDVO). The Framebuffer Color Correction Page appears, as shown in Figure 8.

Figure 8. Framebuffer Color Correction Page

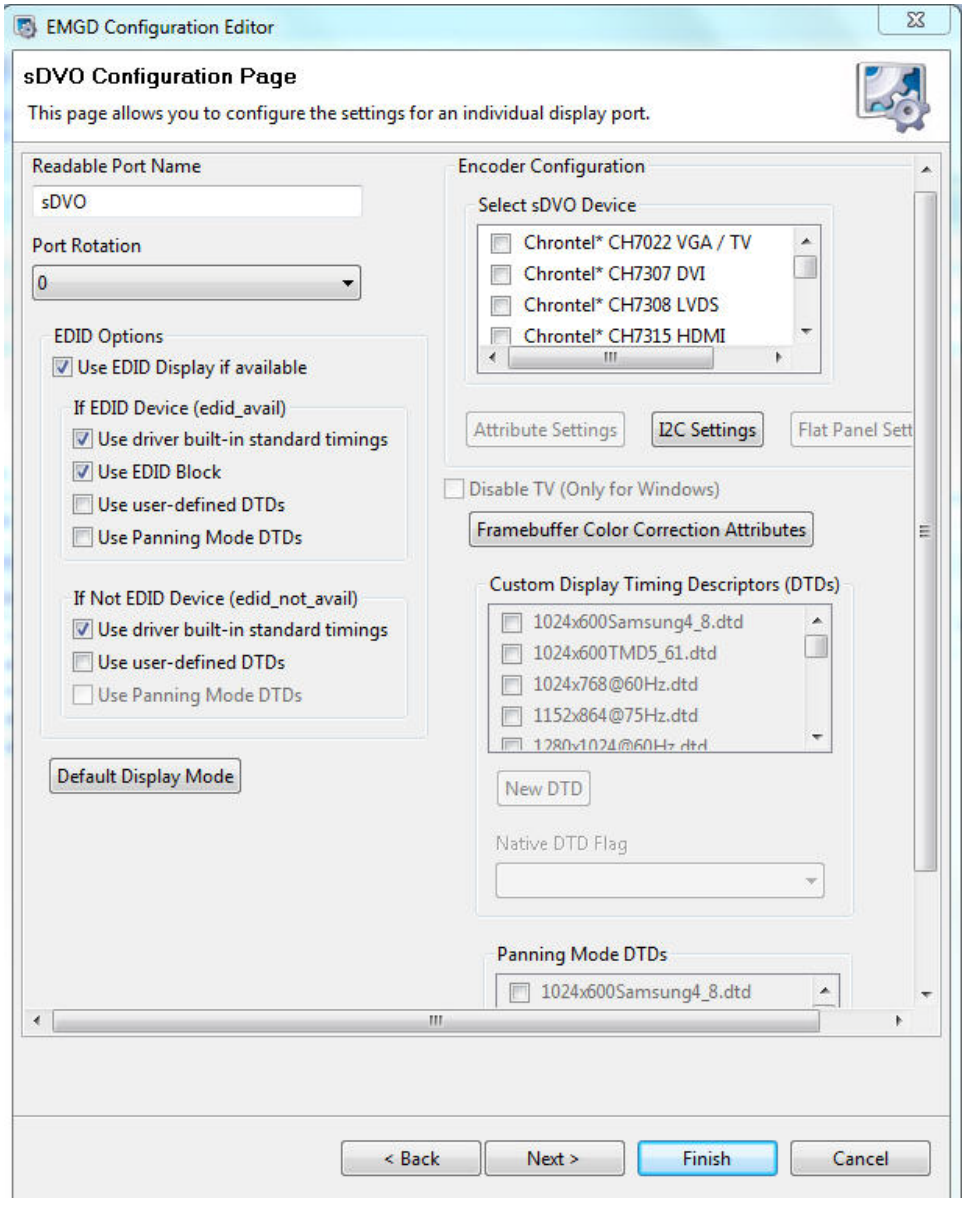

Color Correction Attributes Page
Color Correction Attributes Page
This page allows you to configure color correction attributes.
Gamma Correction Red (0.6 to 6.0)
Gamma Correction Green(0.6 to 6.0)
Gamma Correction Blue (0.6 to 6.0)
Brightness Correction Red (-127 to 127)
Brightness Correction Green (-127 to 127)
Brightness Correction Blue (-127 to 127)
Contrast Correction Red (-127 to 127)
Finish
Cancel

Add your desired values to the correction fields and then click **Finish**.

3.5.2 Configuring Ports

You can configure each port listed in the Port Order box of the Chipset Configuration Page by clicking **Next**. When you do, a port Configuration Page appears similar to the one shown following.

Figure 9. Port Configuration Page



The Port Configuration Page allows you to specify whether to use EDID timings or customized DTD timings for the display connected to this specific port. From this page, you can also specify Attribute Settings, I2C Settings, and Flat Panel Settings and create a new DTD that can be used with any configuration.

The table below describes each field on this page.

Table 10. Port Configuration Settings (Sheet 1 of 2)

Port Configuration Field	Description
Readable Port Name	Enter a name for the port. This is a required field and the name must be between 1 and 12 characters and may contain spaces.
Port Rotation	This list allows you select a rotation for the display connected to this port. You can choose between 0, 90, 180, and 270 degrees. The default is 0.
EDID Options	This section allows you to set EDID options for the display. The Intel® EMGD supports three different types of EDID display modes: • Built-in display modes: These modes are hard-coded in the Intel® EMGD. These modes can be filtered based on the EDID block. • EDID Block: These are Detailed Timing Descriptors read from an EDID display. An EDID display can contain DTD as well as other information about the display. • User-specified DTDs. See "Advanced EDID Configuration" on page 47 for more information on EDID configuration flags. If you want to use the display's EDID information if it is available, click the **Use EDID Display if Available** check box. If the display attached to this port contains EDID information, you can choose one or more of the following options from the If EDID Device section to determine which set of timings to use for the display connected to the port: • Use driver built in standard timings — If this box is checked, the standard timings built into the Intel® EMGD are used. • Use EDID block — If this box is checked, the EDID block is used. • Use user-defined DTDs — If this box is checked, a user-defined DTD is used. You can select which DTD to use by checking the appropriate box in the Custom Display Timings Descriptors (DTDs) section. If no DTDs are defined, you can click **New DTD** and create a custom DTD. For information on creating custom DTD, refer to Table 6 on page 22. • Use Panning Mode DTDs — If this box is checked, a panning mode DTD is used. You can select which panning modes to use by checking the appropriate box in the Panning Mode DTDs section. If you select both **Use driver built-in standard timings** and **Use EDID block**, the Intel® EMGD uses its built-in display timings and the timings provided by the display. If the display attached to this port does not contain EDID information, you can choose one or both of the following options from the If Not EDID Device section: • Use driver built-in standard timings — If this box is checked, the standard timings are used. See "Advanced EDID Configuration" on page 47 for more information on built-in standard timings. • Use user-defined DTDs — If this box is checked, a user defined DTD is used. You can select which DTD to use by checking the appropriate box in the Custom Display Timings Descriptors (DTDs) section. If no DTDs are defined, you can click **New DTD** and create a custom DTD. For information on creating custom DTD, refer to Table 6 on page 22. • Use Panning Mode DTDs — If this box is checked, a panning mode DTD is used. You can select which panning modes to use by checking the appropriate box in the Panning Mode DTDs section. See "Sample Advanced EDID Configurations" on page 48 for example configurations.

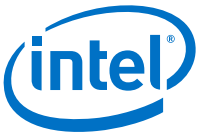


Table 10. Port Configuration Settings (Sheet 2 of 2)

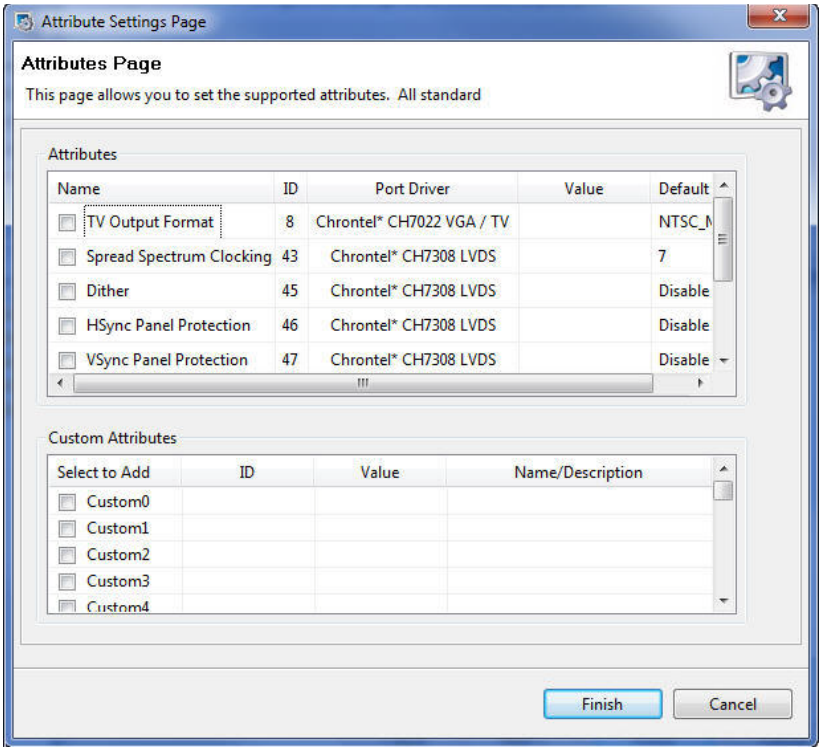
Port Configuration Field	Description
DisplayID Option	This option provides flexibility to enable/disable display rotation configuration based on DisplayID file. To enable display rotation configuration based on DisplayID file, please ensure you do following: • Check the **Determine rotation from device orientation** option box • Leave the **Port Rotation** options under CED LVDS or sDVO configuration page unchecked or set to 0. • Check the **Use EDID display if available** option box and under "If EDID Device (edid_avail)" check the EDID block option for the graphics driver to get the rotation information from the DisplayID file. ***Note:*** If you set the Port Rotation option in CED to a non-zero value, then the graphics will use your setting regardless of the DisplayID option enabled. If you would like to change the DisplayID after driver installation, ensure you delete the DisplayConfigProcessed key through regedit before you change the DisplayID data. Reboot the system after DisplayID data is changed.
Encoder Configuration	This section lets you to specify the type of encoder connected to an sDVO port and encoder Attributes, I2C settings, and Flat Panel settings for the port. The **Select sDVO Device** drop-down list contains the list of all supported sDVO devices. Select the device that will be connected to this port. To change the device's attributes, click the **Attribute Settings** button. Refer to "Changing Port Attribute Settings" for information on device attributes. To change the device's I2C settings, click the **I2C Settings** button. See "Changing I2C Settings" on page 30 for information on I2C settings. To change the device's flat panel settings, click the **Flat Panel Settings** button. See "Changing Flat Panel Settings" on page 32 for information for changing flat panel settings.
Disable TV (Only for Windows)	This option appears only for the sDVO Configuration Page. It allows you to disable TV Out for CH7317 and CH7022. ***Note:*** TV Out is enabled by default by the driver unless it is set to Disabled in CED. For CH7317, the user must choose Disable TV to disable TV detection in the driver because the CH7317 chip does not have TV Out and it incorrectly reports TV encoders to the driver.
Framebuffer Color Correction Attributes	Framebuffer Color Correction Attributes allow you to adjust the main Frame Buffer color attributes. See "Framebuffer Color Correction Attributes" on page 25.
Custom Display Timing Descriptors (DTDs)	The **Custom Display Timing Descriptors (DTDs)** drop-down list contains the list of user-defined timing descriptors. Select the DTD for the display that will be connected to this port. • New DTD — To create a custom descriptor, see Section 3.4, "Creating a New Customized DTD" on page 20 • Native DTD Flag — The Native DTD list lets you choose whether to use a display's built-in timings.
Panning Mode DTDs	The panning mode allows you to set a resolution that is larger than the native resolution of the display panel. The **Panning Mode DTDs** drop-down list contains the list of standard panning mode DTDs. Select the DTD for the display that will be connected to this port.

3.5.2.1 Changing Port Attribute Settings

When you click the **Attributes Settings** button from the Encoder Configuration section of the Port Configuration Page, CED displays a page of attributes for the selected encoder device. The actual page that appears depends upon the encoder device selected and only the attributes that apply to the selected encoder appear. For a full description of all attributes for all supported encoders, refer to Appendix A, "Port Driver Attributes".

Figure 10 shows a sample Attributes Settings Page for the Chrontel CH7022 and CH7308 encoders.

Figure 10. Attribute Settings Page for the Chrontel CH7022/CH7308 Encoders



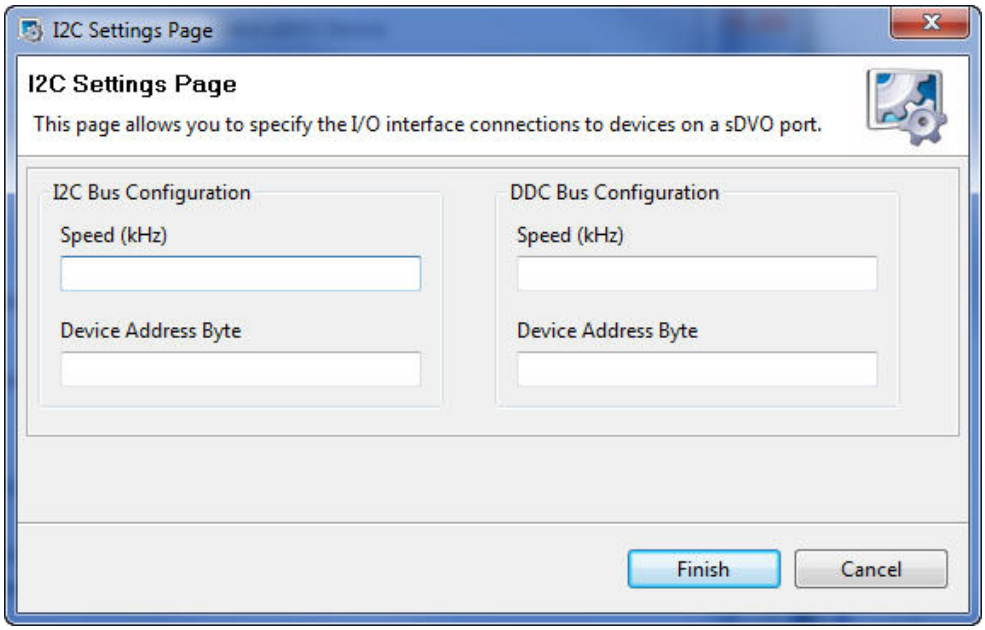
When the Attributes Settings Page first appears, it shows the **Use Default** box checked for all attributes.

To change a default value, clear the **Use Default** check box and enter a new value. For a description of all attributes for all supported encoders, see Appendix A, "Port Driver Attributes".

3.5.2.2 Changing I2C Settings

The I2C Settings Page allows you to specify the I/O interface connections to devices on an sDVO port. When you click **I2C Settings** from the Port Configuration Page, the following screen appears.

Figure 11. I2C Settings Page



The following table describes each field on this page.

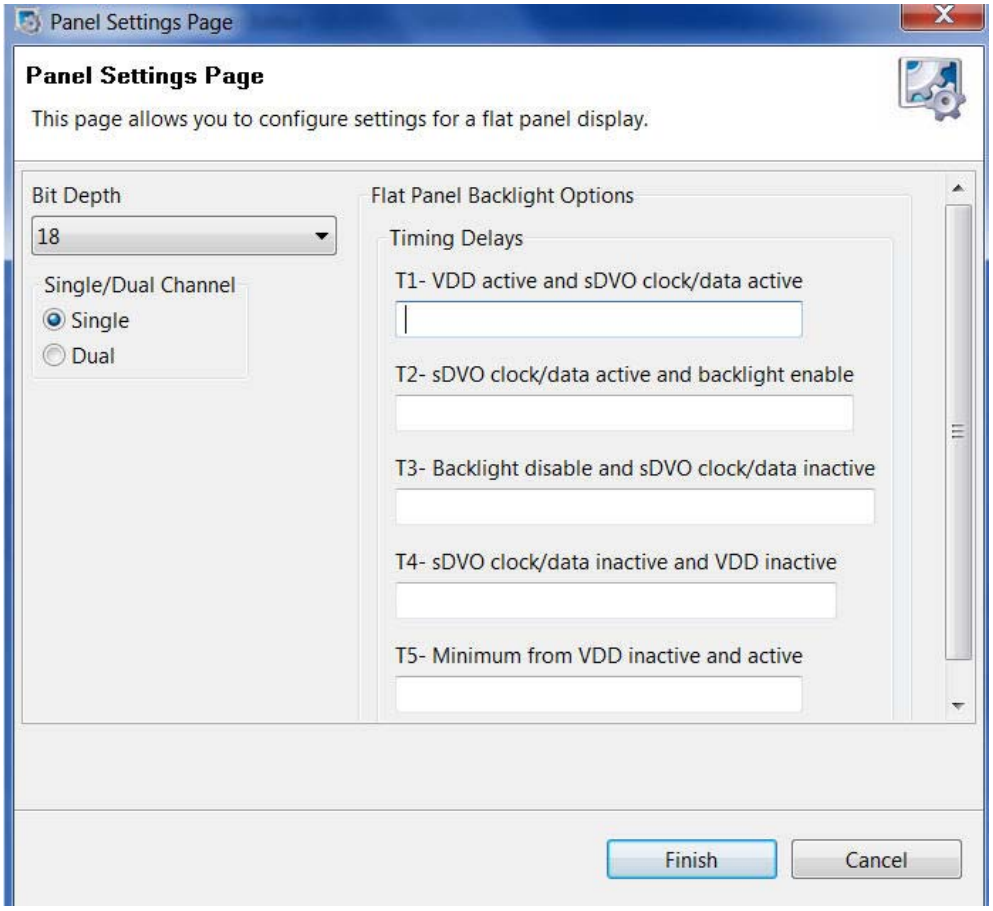
Table 11. I2C Settings

I2C / DDC Bus Configuration	Description
Speed (KHz)	Speed of I2C bus for the device and for the EDID device. The range for these two fields is 10-400 KHz.
Device Address Byte	Enter a device address byte for the device that this port is connected to in these boxes: • The I2C device address is for reading and writing device registers. The device address byte must be in 8-bit format with the 7-bit slave address assigned to its bits 7:1 and bit 0 set to 0. • The DDC Device Address Byte is the I2C device address for reading EDID data from the display through the DDC bus.

3.5.2.3 Changing Flat Panel Settings

The Panel Settings Page allows you to specify settings for a flat panel display connected to this sDVO port. When you click **Flat Panel Settings** from the Port Configuration Page, the following screen appears.

Figure 12. Panel Settings Page for sDVO on CH7308


Panel Settings Page
Panel Settings Page
This page allows you to configure settings for a flat panel display.
Bit Depth
18
Single/Dual Channel
Single
Dual
Flat Panel Backlight Options
Timing Delays
T1- VDD active and sDVO clock/data active
T2- sDVO clock/data active and backlight enable
T3- Backlight disable and sDVO clock/data inactive
T4- sDVO clock/data inactive and VDD inactive
T5- Minimum from VDD inactive and active
Finish
Cancel

The table below describes each section of this page.

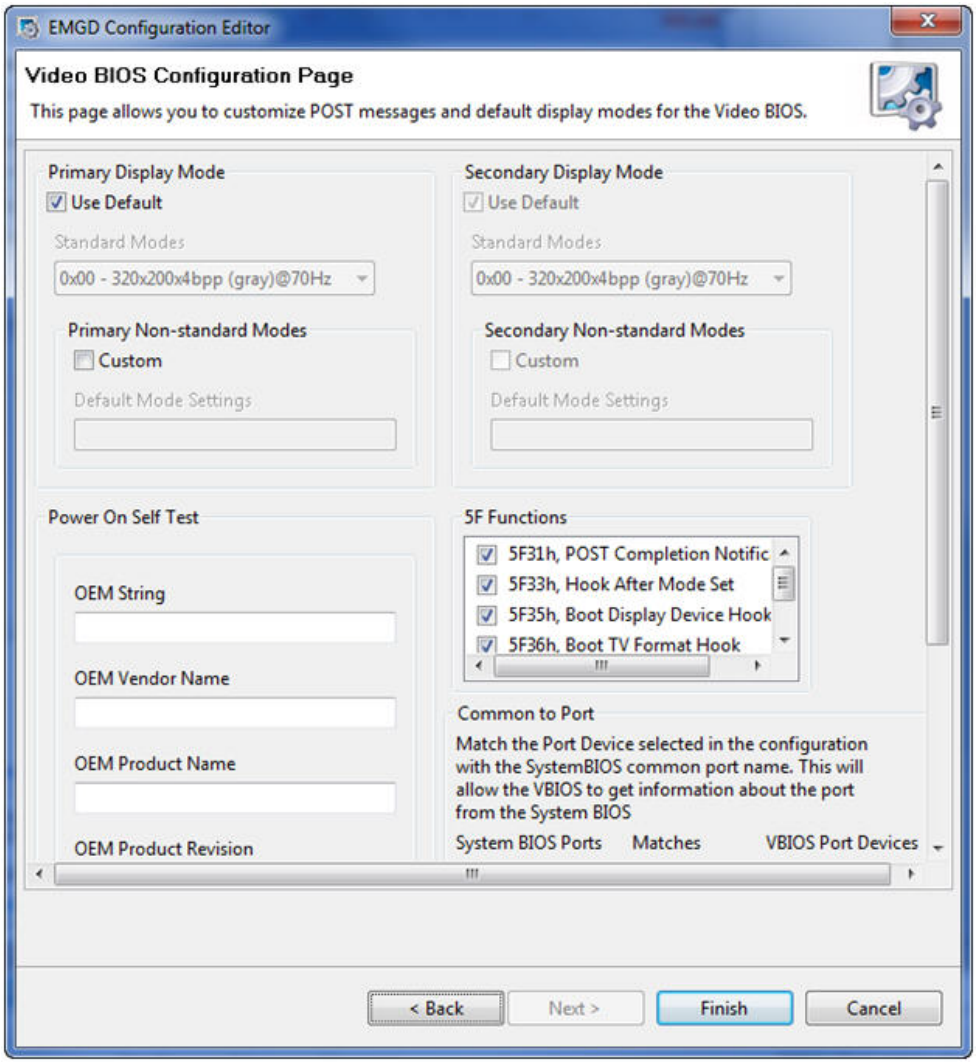
Table 12. Panel Settings Options

Flat Panel Settings	Description
Single/Dual Channel (Applies only to Chrontel 7308)	Select the type of panel, Single or Dual channel. This setting is not supported for internal LVDS.
Bit Depth	This list lets you select a color depth for the panel. You can choose either 18 or 24 bit color depth. The default is 18.
Flat Panel Backlight Options	This section provides options for controlling the backlight of the flat panel display and specifying timing delays. The backlight Control Method is always enabled.
Timing Delays	This section lets you specify timing delays for the backlight signals as follows: • T1-VDD active and sDVO clock/data active. • T2-DVO active and backlight enable. • T3-Backlight disable and DVO clock/data inactive. • T4-DVO clock/data active and inactive. • T5-Minimum from VDD inactive and active. For Internal LVDS, the timing range is as follows: • T1 to T4: 0-409, increment by 1. • T5: 1-1600, increment by 50. For CH7308 and CH7036, the timing range is as follows: • T1 to T4: 0-4095, increment by 1. • T5: 1-<Max 4 byte integer value>, increment by 50. ***Note:*** Timers are very specific to the panel you are using. If they are set incorrectly the display can be damaged or ruined. Please refer to the datasheet for your display to determine the correct settings.

3.5.3 Configuring the Video BIOS

The final page of the Intel® EMGD Configuration allows you to configure your video BIOS (if you are creating a configuration that includes the Video BIOS). You can configure the Video BIOS by clicking **Next** after you configure each port. When you do, the following Video BIOS Configuration Page appears.

Figure 13. Video BIOS Configuration Page


EMGD Configuration Editor
Video BIOS Configuration Page
This page allows you to customize POST messages and default display modes for the Video BIOS.
Primary Display Mode
Use Default
Standard Modes
0x00 - 320x200x4bpp (gray)@70Hz
Primary Non-standard Modes
Custom
Default Mode Settings
Secondary Display Mode
Use Default
Standard Modes
0x00 - 320x200x4bpp (gray)@70Hz
Secondary Non-standard Modes
Custom
Default Mode Settings
Power On Self Test
OEM String
OEM Vendor Name
OEM Product Name
OEM Product Revision
5F Functions
5F31h, POST Completion Notific
5F33h, Hook After Mode Set
5F35h, Boot Display Device Hook
5F36h, Boot TV Format Hook
Common to Port
Match the Port Device selected in the configuration with the SystemBIOS common port name. This will allow the VBIOS to get information about the port from the System BIOS
System BIOS Ports
Matches
VBIOS Port Devices
< Back
Next >
Finish
Cancel

From this page, you can customize POST (Power On Self Test) messages and default display modes as well as matching port devices to System BIOS ports.

The table below describes each field on this page.

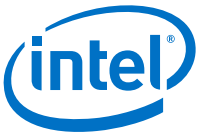


Table 13. Video BIOS Settings Options (Sheet 1 of 2)

Video BIOS Settings	Description
Primary Display Mode	This section allows you to specify a standard or a customized display mode for the primary display. You can select a standard mode from any of the standard modes listed in the drop-down list. If you want to use a customized mode for the primary display, check the **Custom** check box and enter the mode number in the box. For a complete list of customized VGA and VESA modes, refer to Table 19, "Supported VGA Video Display Modes" on page 62 and Table 20, "VESA Modes Supported by Video BIOS" on page 64.
Secondary Display Mode	This section allows you to specify a standard or a customized display mode for the secondary display. You can select a standard mode from any of the standard modes listed in the drop-down list. If you want to use a customized mode for the secondary display, check the **Custom** check box and enter the mode number in the box. For a complete list of customized VGA and VESA modes, refer to Table 19, "Supported VGA Video Display Modes" on page 62 and Table 20, "VESA Modes Supported by Video BIOS" on page 64.
5F Functions	These settings allow you to enable or disable the five System BIOS 15h interrupt hooks. Please see Appendix C, "Intel® 5F Extended Interface Functions" for more information on 5F functions. All five functions are enabled by default.
Common to Port	The Common to Port section lets you match port devices with common System BIOS ports. This allows the Video BIOS to retrieve information about the port from the System BIOS. It allows you to associate standard display names used in most system BIOSs to specific ports that are recognized by Intel® EMGD (for example, LVDS, sDVO). The VBIOS makes this association when the VBIOS calls the System BIOS Intel® 5F interrupt functions. This setting consists of six numbers, where each number is associated with one of the System BIOS displays: 1 : CRT - Standard analog CRT 2 : TV1 - TV Output 1 3 : EFP1 - DVI Flat Panel 1 4 : LFP - Local Flat Panel (Internal LVDS display) 5 : TV2 - TV Output 2 6 : EFP2 - DVI Flat Panel 2 The values above are an example of the typical displays and corresponding order used by a system BIOS. However, this may vary depending on how your system BIOS has implemented the displays and the Intel 5F interrupt functions. The value in each position in the setting should be the associated port device. Using the typical settings above, if you want to associate CRT in the system BIOS with the internal CRT (port 1) and LFP in the system BIOS with internal LVDS (port 4) in the VBIOS, select **CRT** from the VBIOS Port Devices list and click the left arrow button next to the CRT row in the Matches column, and then select LFP from the VBIOS Port Devices list and click the left arrow button next to the LFP row in the Matches column. ***Notes:*** This feature must be compatible with the System BIOS. If the System BIOS does not properly implement the Intel 5F functions, then using the Common to Port feature could cause unpredictable results with the displays. If you are unsure, leave the Matches column blank for all ports to disable this feature. The Display Detect field on the Chipset Configuration page must be set to **Enable** in order for the Common to Port values to be used.
Enable POST messages to display	To enable Power On Self Test (POST) messages to display during the power on sequence, check this box. If left unchecked (i.e., cleared), the POST messages do not display.
OEM String	Enter a string of up to 100 characters. This string appears on the display when the Video BIOS starts up. The default is a blank string.

Table 13. Video BIOS Settings Options (Sheet 2 of 2)

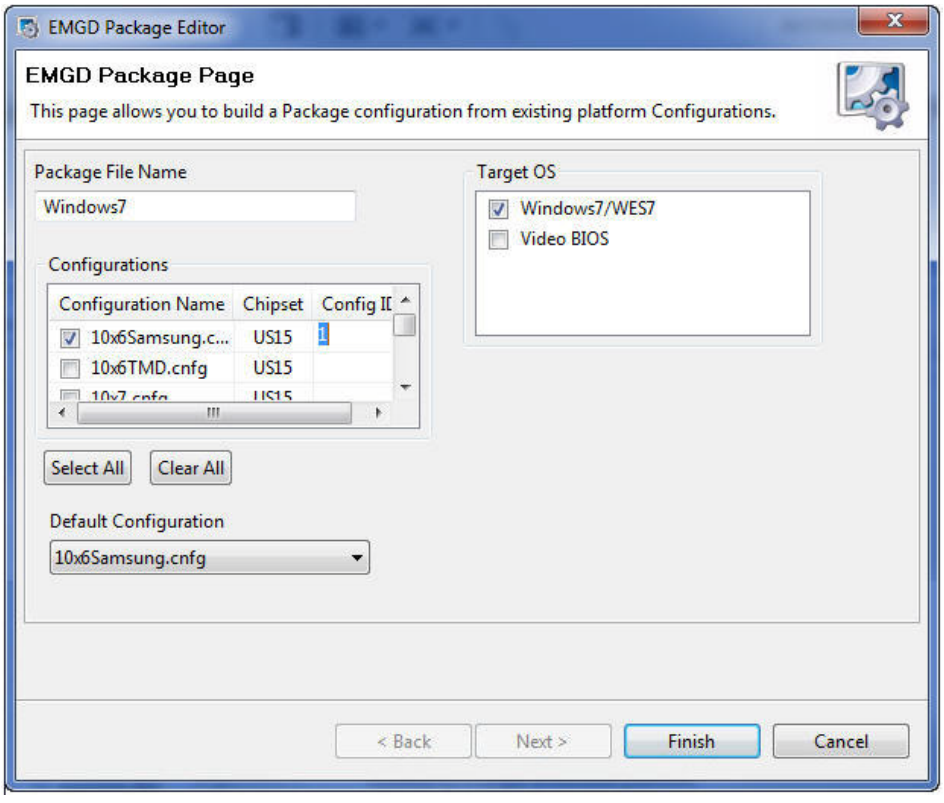
Video BIOS Settings	Description
OEM Vendor Name	Enter a string of up to 80 characters that identifies the OEM Vendor. This string appears on the display when the Video BIOS starts up. The default is a blank string.
OEM Product Name	Enter a string of up to 80 characters that identifies the OEM Product Revision. This string appears on the display when the Video BIOS starts up. The default is a blank string.
OEM Product Revision	Enter a string of up to 80 characters that identifies the OEM Product Revision. This string appears on the display when the Video BIOS starts up. The default is a blank string.
Number of Seconds to Display	Enter the number of seconds to display the above information. The default is 1.

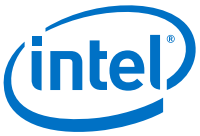
3.6 Creating a New Package

A package consists of one or more configurations and is used to create an installation that works for multiple operating systems and chipset platforms and displays.

To create a new package, click the **New Package** link at the top of the main CED window. The Intel® EMGD Package Page appears.

Figure 14. Intel® EMGD Package Editor Page





The table below describes each field on this page.

Table 14. Intel® EMGD Package Editor Setting Options

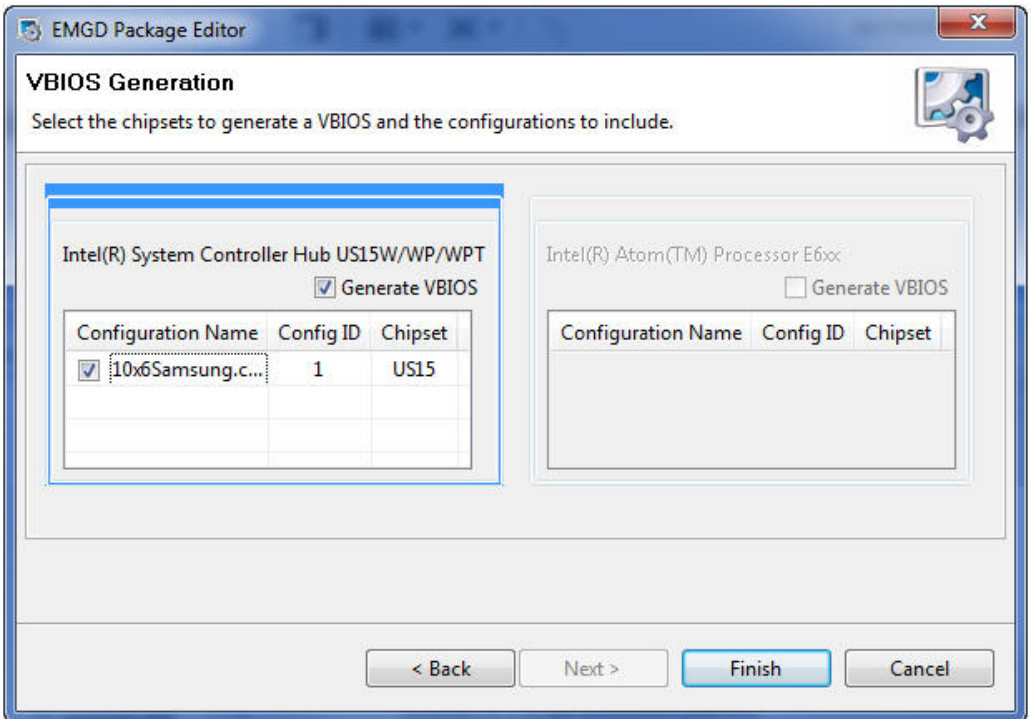
Package Option	Description
Package File Name	Enter a name for the package. This is a required field and the name must be between 1 and 50 characters and may contain spaces.
Configurations	This block shows the configurations that are available to be packaged. Each package consists of one or more configurations, each of which is associated with a specific chipset. To select a configuration, click the check box next to the configuration name. You can select all available configurations by clicking **Select All** located below the Configurations block and clear all configurations by clicking **Clear All**. The Configuration Name column shows the name of each configuration and the Chipset column shows the chipset associated with each configuration. In the Config ID column, you must enter a configuration ID for each configuration. The configuration ID must be a number between 1 and 15. By default, the Package Editor automatically assigns the next available configuration ID when you select a configuration. You can change the default configuration ID by clicking in the edit box and entering a different value.
Default Configuration	The Default Configuration list box allows you to select a default configuration from the configurations you selected in the Configurations block. For single configurations the default is the one selected in the previous option. For multiple configurations, the default is the first one selected in the Configurations list. To have no default configuration, select **None**. See also Section 5.2.1, “Universal INF Configuration” on page 66.
Target OS	This block allows you to select one or more operating systems and Video BIOS for the package. For each target you select, CED produces a configuration file for the selected OS or Video BIOS platform.

If you are not creating a VBIOS package, click **Finish**. When you click **Finish**, CED creates a package that can be used for generating an installation.

3.6.1 Generating a VBIOS Package

If you are creating a package for a VBIOS installation, click **Next**. CED displays the VBIOS Generation page.

Figure 15. VBIOS Generation Page



To generate a VBIOS, click the **Generate VBIOS** check box and select the configurations to include. After selecting the chipset and the configurations, click **Finish**. CED generates a package that includes both the OROM and the TSR for the chipsets and the configurations you selected.

3.7 Generating an Installation

After you have created a package, you can generate an installation for the package by following this procedure.

1. Select a package from the Package folder located on the left pane of the CED main window.
2. Click **Generate Installation**. While the installation is building, CED displays a progress bar. When the installation is complete, CED places the output in the Installation folder on the left pane of the CED window.

For each OS and VBIOS platform specified in the package, CED generates a folder in the `...\workspace\installation` folder under the current folder. For example, if you select a package that contains configurations for all supported operating systems and the VBIOS, CED generates the following folders:

```
...\workspace\installation\<package name_installation>\IEMGD_HEAD_WINDOWS7
...\workspace\installation\<package name_installation>\IEMGD_HEAD_VBIOS
```

These folders contain all the subfolders required for the installation onto the target systems. To complete the installations on the target systems, refer to "Configuring and Installing Microsoft Windows Drivers" on page 66.

Note: With the E6xx platform configuration, CED will generate a 127K vBIOS ROM image; for the US15W platform configuration, CED will generate a 64K vBIOS ROM image.

3.8 Configuring the System BIOS for Use with the Intel® EMGD

Some aspects of configuring the Intel® Embedded Media and Graphics Driver are common across the Video BIOS (VBIOS) and the drivers for the supported operating systems. The following sections provide an overview for configuring both the VBIOS and Intel® EMGD and describe in detail the common components and tools. This section also describes how to configure the system BIOS for the supported systems.

3.9 System BIOS Settings

Before installing Intel® EMGD, you must first configure the system BIOS. The following sections describe the required settings. These descriptions are based on AMIBIOS8* from American Megatrends, Inc., which is the recommended system BIOS to use with Intel® EMGD. Settings may vary if a different system BIOS is used.

3.9.1 GMCH PCIe Device Enabling

The PCIe Device Enabling feature on the Graphics and Memory Controller Hub (GMCH) should be set as specified in the table below.

Table 15. GMCH Device 2, Function 1 BIOS Setting

OS	Chipset
	Intel® Atom™ Processor E6xx, Intel® US15W/US15WP/WPT
Microsoft Windows* 7 and Microsoft Windows* Embedded Standard 7	Disabled

3.9.2 Graphics Mode Select (GMS)

The System BIOS typically allows a portion of physical memory to be dedicated to firmware and graphics driver use. This dedicated memory is known as stolen memory since it is not available to the operating system. The size of this memory is selectable and chipset-specific. Stolen memory is typically used by the firmware and graphics driver to locate the framebuffer, but can also be used as scratch and surface memory. Because it is programmatically set aside during boot by the System BIOS, access to it is direct and does not require OS memory allocation services. Firmware is fully responsible for stolen memory management.

Graphics Mode Select (GMS), or stolen memory, can be set to any of the sizes listed in the table below. Smaller sizes limit the framebuffer size during firmware boot. Larger sizes marginally increase surface allocation performance for the graphics driver.

Table 16. GMS Settings

Chipset	GMS Settings
Intel®US15W/US15WP/WPT	64 MB, 128 MB, 256 MB
Intel® Atom™ Processor E6xx	64 MB, 128 MB, 256 MB

3.9.3 AGP (Accelerated Graphics Port) Aperture Size

The AGP Aperture size controls the total amount of graphics memory that can be mapped in the AGP Aperture. This value can be set from 64 MB up to 256 MB, depending on the chipset. Refer to specific chipset details for information on the valid range.

3.10 VBIOS and Driver Configuration

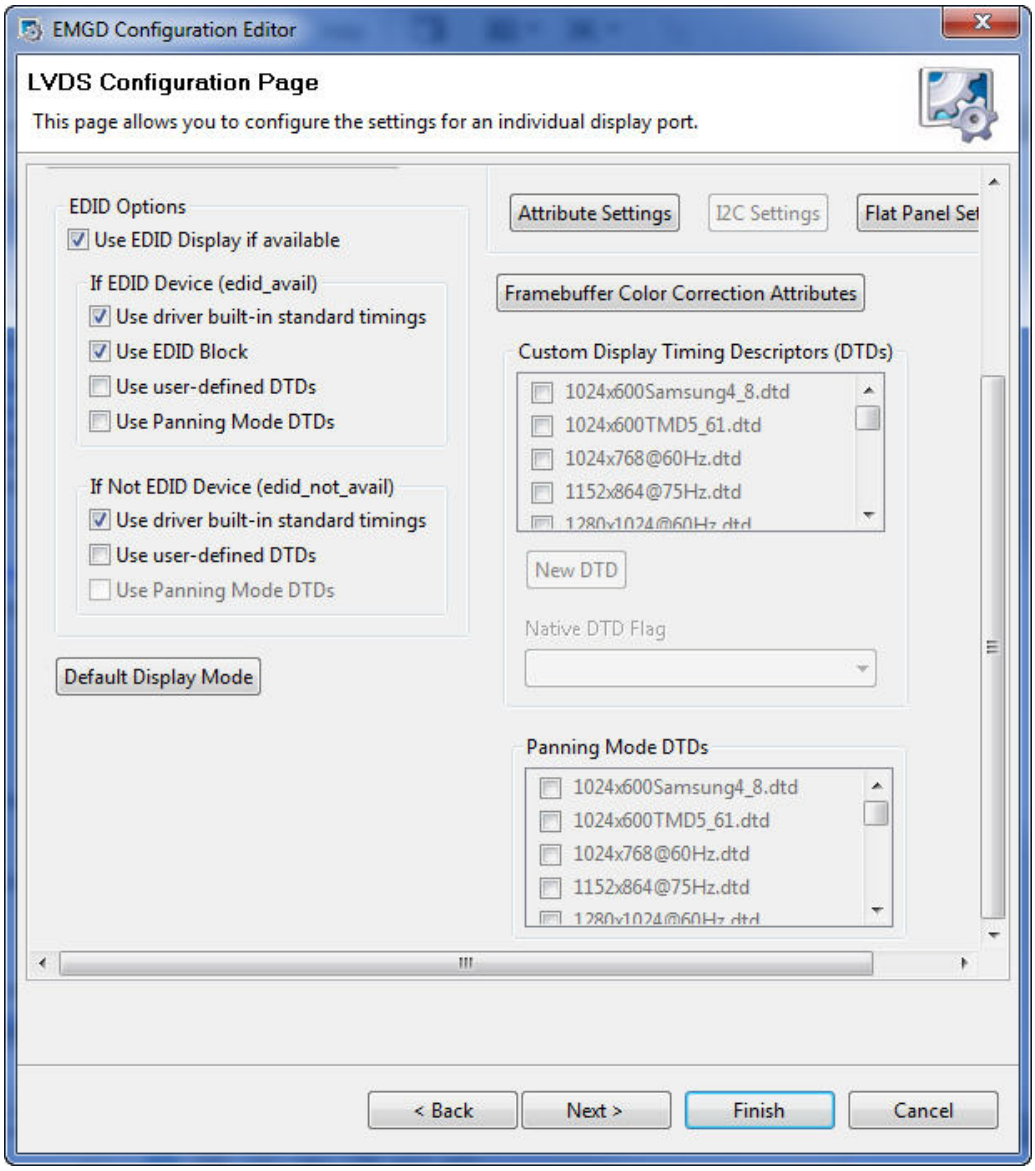
The Intel Embedded Graphics Suite allows user configuration of both the VBIOS and graphics driver as well as programming of Detailed Timing Descriptors (DTDs) for EDID-less panels for both the VBIOS and graphics driver. This is accomplished using CED, which offers several ways to input DTDs, each associated with a potential target panel and display mode for the system. CED generates DTD and configuration settings used by the Intel® EMGD VBIOS, Linux, and/or Windows drivers.

The following example is for a system setup with just an internal LVDS and sample timing parameters for illustration purposes only. You can use this example to set up DTD timings that are specific to your non-standard panels and then activate the panels using a custom mode.

To create a configuration and configure the LVDS options:

1. Create a custom DTD as described in Section 3.4, “Creating a New Customized DTD” on page 20.
2. From the CED main screen, select **New Configuration**.
3. Enter a name for the configuration in the text box provided, for example, *LVDS_test*.
4. Select the platform chipset.
5. In the list of available ports, select **LVDS** and then click **Next**.
6. On the LVDS Configuration Page, clear the checkbox for **Use EDID Display if available**, which disables all the selections under **If EDID Device (edid_avail)**. The screen will be similar to the example below.
7. Select the checkbox for **Use user-defined DTDs**.
8. In the Encoder Configuration section, select **Internal LVDS**.
9. In the Custom Display Timing Descriptors (DTDs) list, select the DTD you created in Section 3.4, “Creating a New Customized DTD” on page 20 for example, *test_LVDS*.

Figure 16. LVDS Configuration Page

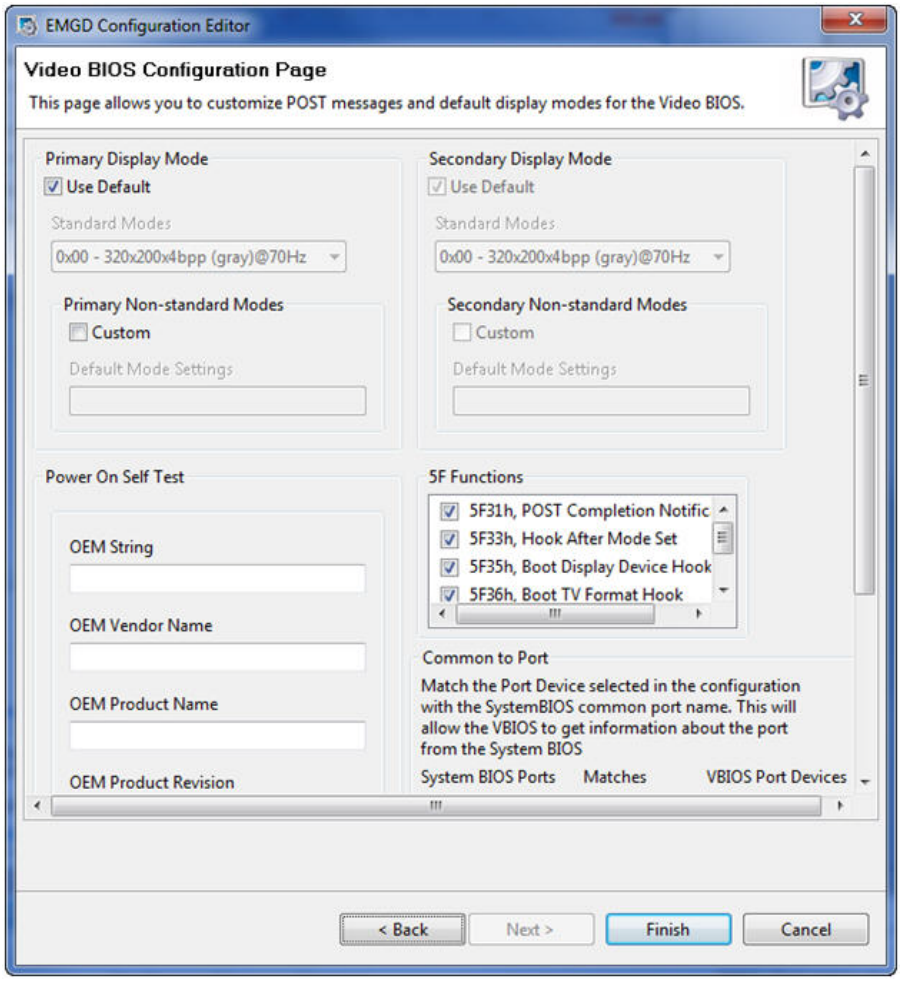


10. Click **Next**.

To set the custom mode:

1. From the Intel® EMGD CED screen (similar to the example below), in the Primary Display Mode section, clear the **Use Default** checkbox.
2. In the Primary Non-standard Modes section, select the checkbox for **Custom**.
3. In the Primary Non-standard Modes section, enter 0x120 in the Default Mode Settings text box. (See a description of the custom modes.)

Figure 17. Video BIOS Configuration Page


EMGD Configuration Editor
Video BIOS Configuration Page
This page allows you to customize POST messages and default display modes for the Video BIOS.
Primary Display Mode
Use Default
Standard Modes
0x00 - 320x200x4bpp (gray)@70Hz
Primary Non-standard Modes
Custom
Default Mode Settings
Secondary Display Mode
Use Default
Standard Modes
0x00 - 320x200x4bpp (gray)@70Hz
Secondary Non-standard Modes
Custom
Default Mode Settings
Power On Self Test
OEM String
OEM Vendor Name
OEM Product Name
OEM Product Revision
5F Functions
5F31h, POST Completion Notific
5F33h, Hook After Mode Set
5F35h, Boot Display Device Hook
5F36h, Boot TV Format Hook
Common to Port
Match the Port Device selected in the configuration with the SystemBIOS common port name. This will allow the VBIOS to get information about the port from the System BIOS
System BIOS Ports
Matches
VBIOS Port Devices
< Back
Next >
Finish
Cancel

Custom Modes

The custom modes begin with 0x120 (0x121 and 0x122 are the same modes in different pixel formats). If there was a second custom mode entered it would begin with 0x123 to 0x125.

From the above DTD 200x200 example, this is what the custom modes represent:

0x120 200x200@8bpp

0x121 200x200@16bpp

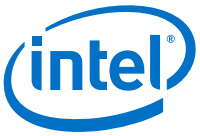
0x122 200x200@32bpp

And if the second custom mode was a 400x400 panel, its custom modes would be:

0x123 400x400@8bpp

0x124 400x400@16bpp

0x125 400x400@32bpp



3.11 Configuration Options

The table below describes available Intel® EMGD settings. The gray rows are block headings and the non-gray rows that follow each heading are settings within the block. Some of these block headings are contained within prior block headings.

Table 17. Parameter Configuration Format (Sheet 1 of 4)

Name	Range/Value	Description
ConfigID	Integer (1-15)	Optional keyword used to specify which configuration is used. The config ID specified here must match one of the configuration IDs defined with CED. If this keyword is omitted, all configurations specified in the config file are used. Note that this keyword is not required for Linux OS and VBIOS configurations.
Config	Integer (1-15)	More than one configuration is valid.
Comment		A quoted string used to identify the origin of the .bin or .inf file.
Name		A quoted string used to identify the configuration name. Name is a required field for VBIOS configuration.
General		Settings that are generic to the configuration.
DisplayConfig	1 – Single 2 – Clone 8 – Extended Default: 8	Used to configure initial state of attached displays. 1 – Single. A single display. 2 – Clone. Primary and secondary displays enabled and configured with separate timing pipes. This allows different timings to be applied to each display. Resolutions can be different on both displays. 8 – Extended. Configures separate pipes to allow primary and secondary displays to have different resolutions and display different content. Upon first boot after the driver installation, this option will enable only the primary display, as the extended modes must be enabled in the operating system (i.e., **Extended Desktop** in the **Display Properties** sheet within Microsoft Windows).
PortOrder	PortOrder must be specified as a quoted string containing five digits. The valid values are: 2 - sDVO B port 4 - Integrated LVDS port (mobile chipsets only) Default: 0 for all keys	Search order for detecting attached displays for the Display Detection feature. When Display Detection is enabled, the PortOrder determines which display is primary and which display is secondary. The port search order can be specified to ensure the port device (sDVO device) is found, based on the system integrator's routing choices. Default ordering is chosen by specifying zeros in the PortOrder keys. Default ordering is chipset specific; see Table 29, "Default Search Order" on page 104.
vbios		This block contains settings for the Video BIOS. Note that you only need to specify the parameters you are actually using. You do not need to specify all the parameters in this block. If you omit any parameters, the vbios uses the default values.
port	2 -sDVO B port 4 - Integrated LVDS port (mobile chipsets only)	Used to define port specific settings.

Table 17. Parameter Configuration Format (Sheet 2 of 4)

Name	Range / Value	Description
rotation	Degrees • 0 • 90 • 180 • 270 Default: 0 degrees	Rotation of the display.
EnableHotPlug	1 - Enable Hot Plug 0 - Disable Hot Plug Default: 1 Enable	This parameter is used to enable or disable the hot plug feature for an sDVO port.
HotPlugDelay	Default 550ms Unit in ms Range 100-1000ms	This parameter is used to enable or disable the hot plug feature for the sDVO port.
edid	0 – Do not read EDID from panel/CRT 1 – Attempt to extract EDID timing data from panel/CRT	If VBIOS/driver reads EDID from panel/CRT.
edid_avail edid_not_avail	Range [16 bits] Valid values (specified in hex): bit 0=0: Do not use built-in standard timings. =1: Use driver built-in standard timings. bit 1=0: Do not use EDID block. =1: Use EDID block and filter modes. (Bit 1 not applicable to edid_not_avail.) bit 2=0: Do not use user-defined DTDs. =1: Use user-defined DTDs. bits 3-15: Reserved for future use.	These two parameters are used to control the available timings for any display. `edid_avail` is used when EDID values are read from the display. If an attempt to read EDID from the display fails or the `edid` parameter is set to 0, then the driver uses the `edid_not_avail` flags. The value for both parameters must be specified as a decimal or hex value, e.g., “3” or “0x3” Defaults: edid_avail: “3” sets Bit 0 = 1, Bit 1 = 1, Bit 2 =0 (Use driver built-in standard timings and EDID block and filter modes.) edid_not_avail: “1” sets Bit 0 = 1, Bit 1 = 0, Bit 2 = 0. (Use driver-built-in standard timings.) Please see Section 3.12, “Advanced EDID Configuration” on page 47 for detailed information.
DIDRotation	Range: 0 - Disable. Do not use rotation setting based on DisplayIDfile. 1 - Enable. Use rotation setting based on the DisplayIDfile for display port configuration	This option provides flexibility to enable/disable display rotation configuration based on DisplayID file. Default: disabled To enable display rotation configuration based on the DisplayID file, please ensure you configure the following parameters: • DIDRotation =1 • rotation =0 • edid =1 • edid_avail = 2 or 3 or 6 or 7 ***Note:*** If you set the Port Rotation option in CED to a non-zero value, then the graphics will use your setting regardless of the DisplayID option enabled. If you would like to change the DisplayID after driver installation, ensure you delete the DisplayConfigProcessed key through regedit before you change the DisplayID data. Reboot the system after DisplayID data is changed.

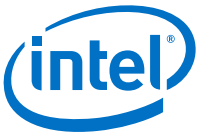


Table 17. Parameter Configuration Format (Sheet 3 of 4)

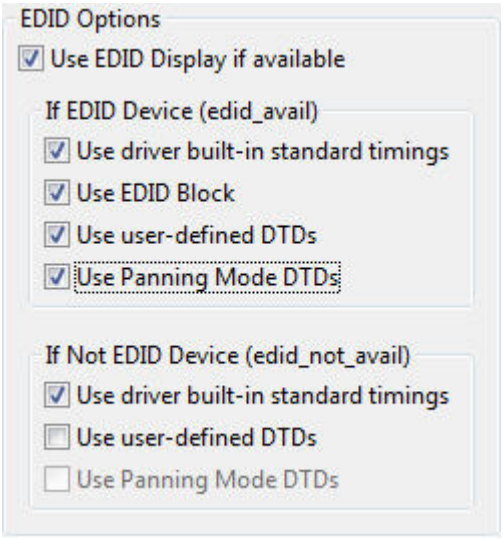
Name	Range/Value	Description
dvo		sDVO device information.
i2cpin	<0-6>	The GPIO pin pair used on the I^2C bus to read and write to sDVO device registers.
ddcpin	<0-6>	The GPIO pin pair used as DDC bus to read panel EDID data.
i2cdab	<0x00-0xff>	I^2C device address for reading and writing device registers. The device address should be in 8-bit format with the 7-bit slave address assigned to its bits 7:1 and bit 0 set to 0.
ddcdab	<0x00-0xff>	I^2C device address for reading EDID data from display through the DDC bus.
i2cspeed	[10-400]. Units in KHz	Speed of I^2C bus for sDVO device.
ddcspeed	[10-400]. Units in KHz	Speed of I^2C bus for EDID device.
fpinfo		Panel-specific information.
bkltt1	Range [0 -0xfff]. Units of 1ms => the limit specified in your hardware specifications. For example, the maximum for the CH7307 is 409 ms.	(T1) Time delay between VDD active, and sDVO clock/data active. Zero indicates no delay required.
bkltt2		(T2) Time delay between sDVO clock/data active and backlight enable.
bkltt3		(T3) Time delay between backlight disable and sDVO clock/data inactive.
bkltt4		(T4) Time delay between sDVO clock/data inactive and VDD inactive.
bkltt5		(T5) Minimum delay between VDD inactive, and active.
dtd		Denotes a Detailed Timing Descriptor (DTD) block. Settings in this section, except for the `flags` parameter, correspond to the Detailed Timing Block described in the VESA standard "Extended Display Identification Data Standard", Version 3, November 13, 1997.
p_clock	Range [0-0x7fffffff]	Pixel clock value in KHz.
h_active	Range 0-4096 [12 bits]	Horizontal Active.
v_active	Range 0-4096 [12 bits]	Vertical Active.
h_sync	Range 0-1024 [10 bits]	Horizontal Sync Offset.
v_sync	Range 0-64 [6 bits]	Vertical Sync Offset.
h_syncp	Range 0-1024 [10 bits]	Horizontal Sync Pulse Offset.
v_syncp	Range 0-64 [6 bits]	Vertical Sync Pulse Width.
h_blank	Range 0-4096 [12 bits]	Horizontal Blanking.
v_blank	Range 0-4096 [12 bits]	Vertical Blanking.
h_border	Range 0-256 [8 bits]	Horizontal Border. Currently not supported.
v_border	Range 0-256 [8 bits]	Vertical Border. Currently not supported.
h_size	Range 0-4096 [12 bits]	Horizontal Size. Currently not supported.
v_size	Range0-4096 [12 bits]	Vertical size. Currently not supported.

Table 17. Parameter Configuration Format (Sheet 4 of 4)

Name	Range / Value	Description
flags	Range [32 bits] Valid values: bit 31 0 - Non-interlaced 1 - Interlaced bit 27 0 - vertical sync polarity active low 1 - vertical sync polarity active high bit 26 0 - horizontal sync polarity active low 1 - horizontal sync polarity active high bit 25 0 - blank sync polarity active high 1 - blank sync polarity active low bit 20 0 - disable display panning (default) 1 - enable display panning bit 17 0 - Normal DTD 1 - Panel/display Native DTD All other bits Do not use any other bits; all other bits must be set to 0.	Interlace, Horizontal polarity, Vertical polarity, Sync Configuration, etc. Note that these flags are Intel® EMGD specific and do not correspond to VESA 3.0 flags. For example, to set Interlaced with Horizontal Sync Polarity high (bits 31 and 26), then the flags value = 0x84000000. (Binary = 10000100 00000000 00000000 00000000)
attr	0-0xFFFF	Attribute values that are specific to the sDVO device for the port. See Appendix A, “Port Driver Attributes” for specific attribute IDs and associated values.
id <Attribute ID>	0 -4294967296	id = <value>. Both the Attribute ID and its value should be specified in decimal. For example, to set brightness to 50, you specify id 0 = 50 See Appendix A, “Port Driver Attributes”

3.12 Advanced EDID Configuration

Shown in the following EDID Options example, the If EDID Device (`edid_avail`) and If Not EDID Device (`edid_not_avail`) options in CED are found on the CRT, sDVO, LVDS, and TV Out configuration pages.



These options control the available timings for any display. Use the `edid_avail` parameter when EDID information is read from the display. If the driver cannot read EDID information from the display or if the `edid` parameter is set to "`0`" (disable), then use the settings of the `edid_not_avail` parameter.

The default behavior of `edid_avail` is to use the driver's built-in standard timings and EDID block and filter modes. The default for `edid_not_avail` uses the driver's built-in standard timings. Please see Table 17 in Section 3.11 for more information on these parameters.

The driver will use 1024x768, 800x600, and 640x480 as built-in standard timings if there was no user-defined DTDs specified in the INF and if any of the following conditions are met:

1. The edid configuration flags specified only to use the driver built-in standard timings. Examples:
   "edid" = 0, "edid_avail" = (any value), "edid_not_avail" = 0
   "edid" = 1, "edid_avail" = 0, "edid_not_avail" = 0
2. The edid configuration flags resulted in a NULL timing list (i.e., user requested to use user-defined DTDS, but there were no user-defined DTDs specified in the INF file or the user requested to use EDID-DTDs, but the panel contains no EDID information). Examples:
   "edid" = 0, "edid_avail" = (any value), "edid_not_avail" = 5 (no user-DTDs were defined)
   "edid" = 1, "edid_avail" = 0, "edid_not_avail" = 4 (no user-DTDs were defined)
   "edid" = 1, "edid_avail" = 4, "edid_not_avail" = (any value) (no user-DTDs were defined)
   "edid" = 0, "edid_avail" = (any value), "edid_not_avail" = 2 (panel has no EDID information)

Note: This applies to internal and external LVDS as well as SDVO displays (excluding TV). For internal and external LVDS displays, the driver will use 1024x768 as the native timing for the LVDS panel.

The Intel® EMGD supports these different types of EDID display modes:

- **Built-in display modes**. These modes are hard-coded in the Intel® EMGD. These modes can be filtered based on the EDID block.
- **EDID-DTDs**: These are Detailed Timing Descriptors read from the EDID block. EDID can have these DTDs along with other information about the display.
- **User-specified DTDs** defined in CED. See Section 3.12.2.
- **User Panning Mode DTDs** defined in CED. See Section 3.14.

The Advanced EDID Configuration supports different possible combinations of display modes when an EDID display is present along with user-specified DTDs.

3.12.1 Sample Advanced EDID Configurations

The table below presents various EDID configurations and the EDID settings in CED used for those configurations.

Table 18. Sample Advanced EDID Configurations

Configurations	CED Settings	Description
1. Use all built-in modes and any EDID-DTDs when the display has EDID information. 2. Use filtered built-in modes (1024x768, 800x600, 640x480) when the display does not contain EDID information.	edid = 1 edid_avail = 3 edid_not_avail = 1	Default values.
1. Use all built-in modes and EDID-DTDs when the display has EDID information. 2. Use only user-DTDs otherwise.	edid = 1 edid_avail = 3 edid_not_avail = 4	This configuration allows the Intel® EMGD to use its built-in display modes and the modes provided by the display. If the Intel® EMGD is unable to read EDID information from the display, then the Intel® EMGD uses the user-DTDs defined in CED.
1. Use only user-DTDs regardless of connected display. (Typically used for a custom panel that only supports user-defined DTDs.)	edid = 0 edid_avail = (any value) edid_not_avail = 4	Only user-DTDs defined in CED are used.
1. Use EDID-DTDs for an EDID display. 2. Use user-DTDs for a non-EDID display.	edid = 1 edid_avail = 2 edid_not_avail = 4	This configuration uses the EDID-DTDs when detecting an EDID display and EDID information comes from the display. If the driver detects a non-EDID display, then the Intel® EMGD uses user-DTDs defined in CED.
1. Use only EDID-DTDs and user-DTDs for an EDID display. 2. Use user-DTDs only for a non-EDID display.	edid = 1 edid_avail = 6 edid_not_avail = 4	This configuration uses both EDID-DTDs and user-DTDs when the Intel® EMGD detects an EDID display. If the driver detects a non-EDID display, then the Intel® EMGD uses user-DTDs defined in CED.

3.12.2 User-Specified DTDs

CED provides the ability to input DTD data directly. There are numerous sources of DTD data: VESA, panel manufacturers, etc. See Creating a New Customized DTD for more information.

3.13 Using an External PCIe Graphics Adapter as the Secondary Device on Windows* 7 and Windows* Embedded Standard 7

You can configure an external PCIe card to work with the Intel® EMGD as follows:

- The external PCIe card as the secondary graphics adapter and the GMCH internal graphics device as the primary.

Note: When using an ATI card, first install the ATI driver and do not reboot the machine. Reboot after installing Intel® EMGD.

Intel® EMGD lets you specify which display is primary, secondary, and tertiary. It allows Extended and Clone configurations on the internal graphics device when the external PCIe device is the secondary graphics adapter.

An external PCIe graphics driver runs independently without sharing resources with Intel® EMGD.

Figure 18 shows the interaction between Intel® EMGD and the External VGA driver when Intel® EMGD is booted as the primary driver. The drivers do not share hardware resources. The OS decides the framebuffer content and handles it by drawing to the respective driver independently.

Figure 18. Intel® EMGD as Primary Driver and External PCIe Graphics Card as Secondary Driver

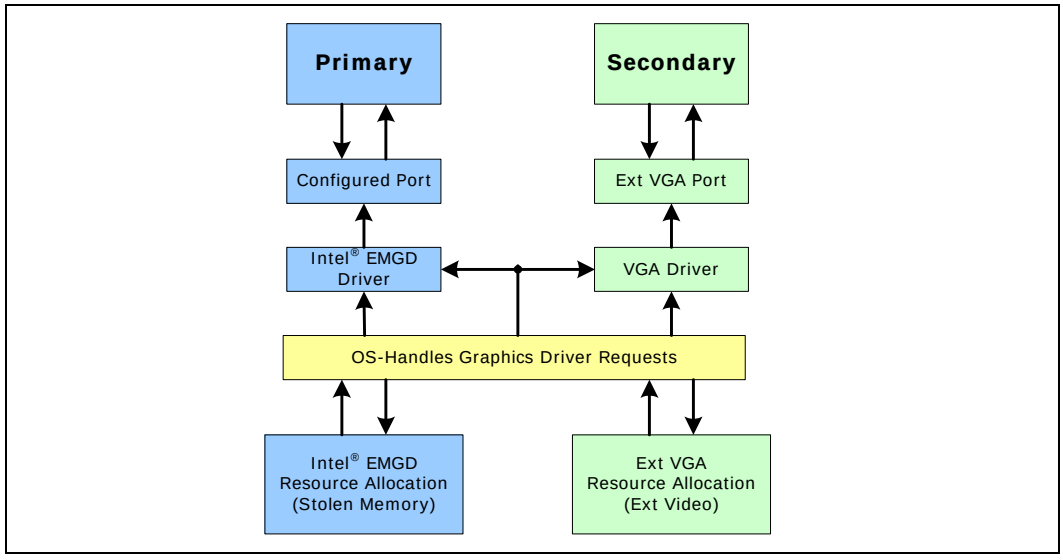
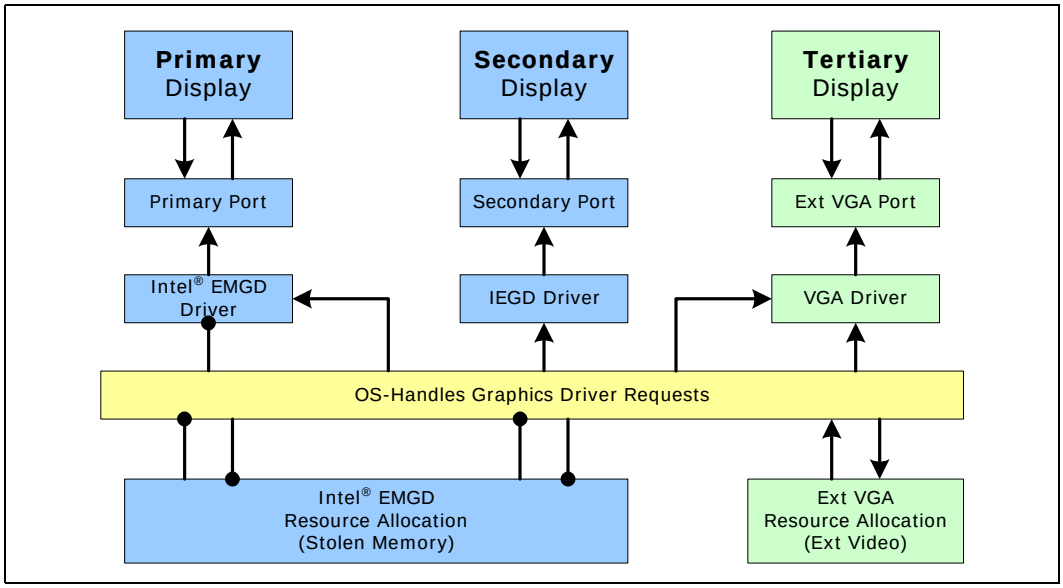


Figure 19 shows a sample configuration where the internal graphics device is primary and configured to use two ports to drive two displays while an external PCIe graphics adapter is used to drive a tertiary display. Note that regardless of the number of ports being assigned to a driver, the external PCIe graphics run independently without sharing resources with Intel® EMGD.

Figure 19. Intel® EMGD as Primary Driver with Two Displays and External PCIe Driving a Tertiary Display



3.14 Panning Modes DTDs

Intel® EMGD introduces Panning Mode DTDs control to support a small display with higher resolutions. Use this option to set a resolution that is larger than the native resolution of the display.

Note: Panning Mode is supported only on LVDS displays (internal LVDS or sDVO LVDS displays).

The Panning Mode DTDs control applies to both EDID Device and Not EDID Device. Here is the logic of Panning Mode DTDs control on the CED:

- When Use Panning Mode DTDs option is checked, the Panning Mode DTDs control is enabled.
  - CED settings:
    - edid_avail |= 8 if Use Panning Mode DTDs is checked in the If EDID Device group control and
    - edid_not_avail |= 8 if Use Panning Mode DTDs is checked in the If Not EDID Device group control
- If Not EDID Device, the Use Panning Mode DTDs option is enabled only when the Use user-defined DTDs option is enabled. If the Use user-defined DTDs is not checked, then Use Panning Mode DTDs is disabled.
- If the DTD is selected in the Use user-defined DTDs control, the same DTD cannot be used in the Panning Mode DTDs control, i.e., the DTD cannot be the same for the **Use user defined DTDs** and the **Panning Mode DTDs**
- If the user selects a native mode from the **Use User-Defined DTD** list, the Panning Mode DTDs list contains the selected non-native user-defined DTDs that are greater than or equal to, i.e., either the width or height is greater or equal to the native mode DTD.

3.15 Scaling and Centering Configurations

This release supports the following scaling and centering configurations:

- Upscaling for the Chrontel CH7308 LVDS Transmitters
- Internal LVDS Scaling
- Centering

See the following topics for configuration details:

- "Upscaling for the Chrontel CH7308 LVDS Transmitters"
- "Internal LVDS Scaling with EDID Panels"
- "Centering for Internal LVDS and sDVO"

3.15.1 Upscaling for the Chrontel CH7308 LVDS Transmitters

Note: In Windows 7, upscaling is supported through the CH7308 LVDS transmitter. When a lower resolution (compared to native resolution) is selected, the panel will be scaled to fit the panel while maintaining the aspect ratio.

The Intel® EMGD can upscale lower-resolution modes (those smaller than the size of the respective panel) to the native size of the panel connected to a Chrontel CH7308* LVDS transmitter.

The Intel® EMGD uses a user-supplied DTD with the native flag set (also known as native DTD) as native timing for the panel connected to a CH7308 transmitter.

If the user does not supply a native DTD, Intel® EMGD uses 1024x768 as the default native timing and 800x600 and 640x480 as built-in standard timings.

To support upscaling, the LVDS transmitters require setting the pipe to native timing of the panel despite the user-selected resolution. It also requires finding the native timing (also known as native DTD) of the panel based on user-supplied configuration information.

The CH7308 (sDVO) port drivers limit the list of supported modes to the size of panel. The port drivers also mark one of the timings as native DTD as follows (it goes to the next step only if native DTD is not found in the current step).

1. It finds the timing with the user-defined DTD with the native DTD flag set. This becomes the native DTD for the panel.
2. If the panel is an EDID panel and user selected to use EDID DTDs, then the port driver marks the EDID DTD as native DTD.
3. If the user supplies a DTD without the native DTD flag set, then the port driver marks this one as the native DTD.
4. If none of the above steps works, the driver uses 1024x768 as the default native timing and 800x600 and 640x480 as built-in standard timings.

3.15.2 Internal LVDS Scaling with EDID Panels

The Internal LVDS connected to an EDID Panel supports scaling of modes other than native mode. To support this, the port driver exports information to the EDID parser that it can scale. The EDID parser does not remove other modes (that is, non-native modes) from the mode table. It only marks the native mode. When the Intel® EMGD queries the port driver on which modes are supported, the port driver then removes any modes that cannot be scaled (up or down depending on the port's hardware capability). When mode-setting occurs, the second display in Clone mode can indeed support non-native modes even though the panel had EDID. This occurs only if a native mode can be found the port driver can scale. Otherwise, the port driver ignores the scaling information and the Intel® EMGD proceeds normally.

The driver also supports Internal LVDS Scaling on EDID-less panels. The steps that enable this are the same as those described for the scaling of Chrontel LVDS transmitters in Section 3.15.1.

3.15.3 Centering for Internal LVDS and sDVO

There is no user-defined centering and upscaling (Panel_Fit attribute 18) support in CED. Centering is supported only through Intel® EMGD as shown below.

- For internal LVDS,
  - Intel® EMGD supports centering on US15W
  - Intel® EMGD supports maintaining aspect ratio instead of centering on E6xx
- For SDVO (includes external LVDS), Intel® EMGD supports centering on both US15W and E6xx.

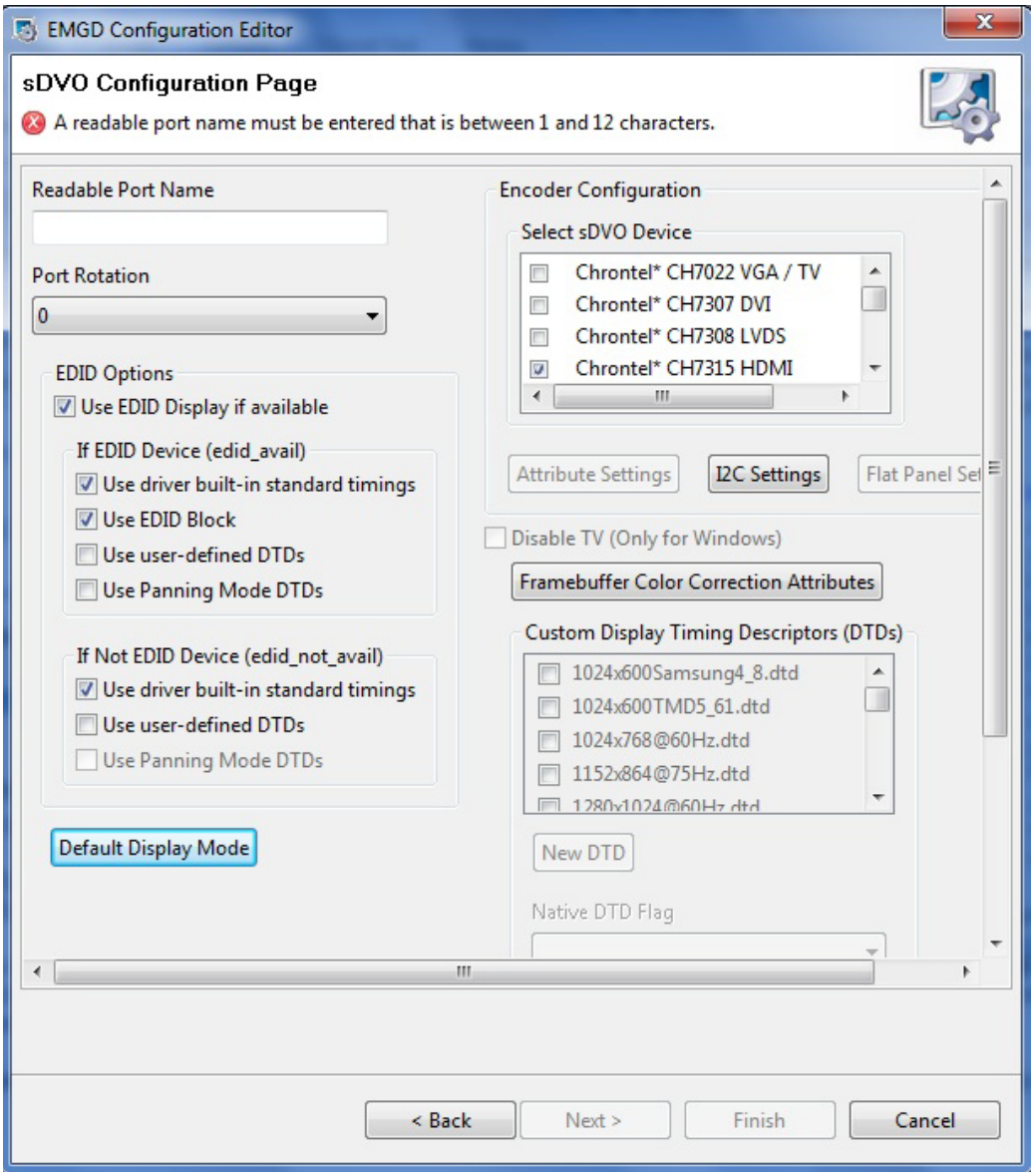
Note: SDVO display is center scaling capable, but this needs the Panel_Fit attribute available in CED.

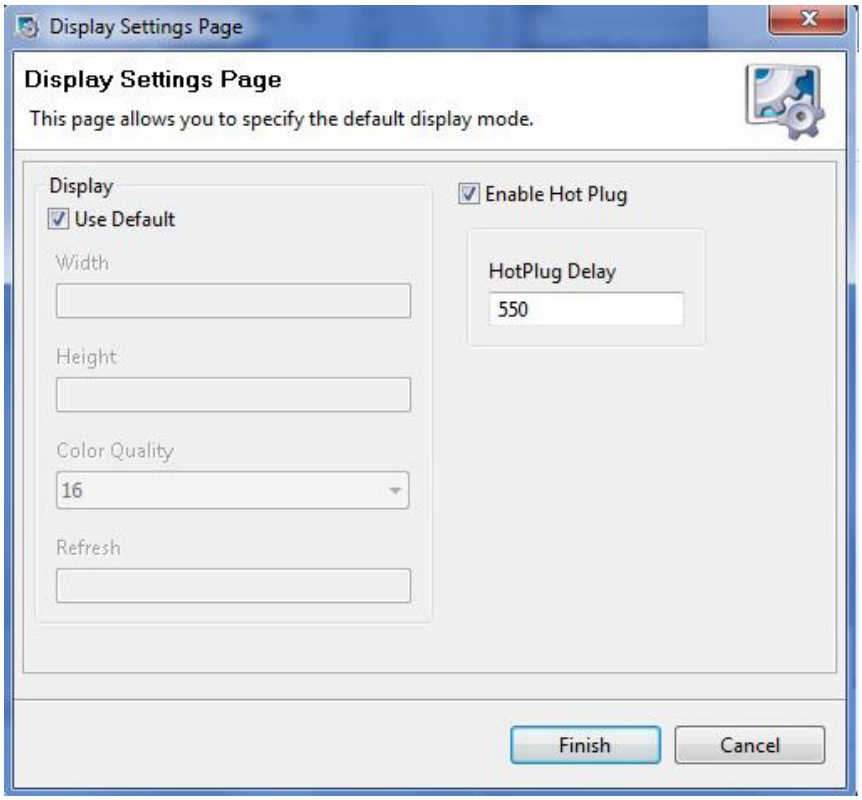
3.16 Hot Plug Support

3.16.1 Enabling Hot Plug

To enable the hot plug feature, configure the sDVO configuration page “Enable Hot Plug” and “Hot Plug Delay” options in CED before generating the installation driver or you could manually include the parameters in the INF file. The “Enable Hot Plug” option is set to “1” which means enabled by default; default value for HotPlugDelay is 550. Example of the parameter in INF file:

```
HKR, ALL\1\Port\2\General , EnableHotPlug, %REG_DWORD%, 1
HKR, ALL\1\Port\2\General , HotPlugDelay , %REG_DWORD%, 550
```

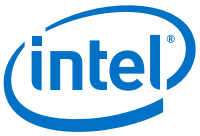

EMGD Configuration Editor
sDVO Configuration Page
A readable port name must be entered that is between 1 and 12 characters.
Readable Port Name
Port Rotation
0
EDID Options
Use EDID Display if available
If EDID Device (edid_avail)
Use driver built-in standard timings
Use EDID Block
Use user-defined DTDs
Use Panning Mode DTDs
If Not EDID Device (edid_not_avail)
Use driver built-in standard timings
Use user-defined DTDs
Use Panning Mode DTDs
Default Display Mode
Encoder Configuration
Select sDVO Device
Chrontel* CH7022 VGA / TV
Chrontel* CH7307 DVI
Chrontel* CH7308 LVDS
Chrontel* CH7315 HDMI
Attribute Settings
I2C Settings
Flat Panel Set
Disable TV (Only for Windows)
Framebuffer Color Correction Attributes
Custom Display Timing Descriptors (DTDs)
1024x600Samsung4_8.dtd
1024x600TMD5_61.dtd
1024x768@60Hz.dtd
1152x864@75Hz.dtd
New DTD
Native DTD Flag
< Back
Next >
Finish
Cancel



Sometimes reading of EDID may fail, especially when the user wiggles the connector while attaching the display. You can try to fine tune the `HotPlugDelay` timing to suit your usage, within the range from 100ms to 1000ms with stepping of 10ms. Note that setting the `HotPlugDelay` value too low may prevent the monitor from being detected, while having the value too high will lock the system longer before detecting the monitor. Recommended default value is 550ms.

The hot plug feature is supported for single sDVO or dual display setup; however, note that the hot plug feature does not apply for the LVDS transmitter.

§ §



4.0 Video Firmware

4.1 Overview

The Intel Embedded Video BIOS incorporates many of the features and capabilities of the Intel® Embedded Media and Graphics Driver. The 1.18 version of the VBIOS includes support for the following chipsets:

- Intel® Atom™ Processor E6xx
- Intel® System Controller Hub US15W/US15WP/WPT chipset

Enabling the SMSW instructions used when Intel® EMGD VBIOS sets up its caching functions increases the boot speed during POST and system boot. Caching is vital for the Intel® EMGD VBIOS and it uses SMSW by design. Changes to the Intel® Embedded Media and Graphics Driver VBIOS cannot happen without affecting its performance.

4.2 System Requirements

The new Video BIOS can be built on a host Microsoft Windows* system and moved to the target system. The host system must have a 32-bit Microsoft Windows operating system installed with the capability to execute DOS commands from a command line window.

The target system must contain one of the following Intel chipsets:

- Intel® Atom™ Processor E6xx
- Intel® System Controller Hub US15W/US15WP/WPT chipset

The target system must contain a minimum of 64 MB of RAM.

4.3 Configuring and Building the VBIOS with CED

The Intel® Embedded VBIOS is built with the Intel Configuration Editor (CED). The VBIOS will use the configuration that you specify in CED. The VBIOS is selected to be built when you specify the Video BIOS as a Target OS in your package configuration. After specifying the Video BIOS, follow all CED prompts, and be sure to select “Generate VBIOS” when available. The VBIOS will then be built when you select “Generate Installation” in CED.

Before building your VBIOS, you must set up your DOS environment with the steps below.

1. Download the Open Watcom* C/C++ compiler from http://www.openwatcom.com. The User Build System for the VBIOS relies on the Open Watcom C/C++ compiler to be able to build a 16-bit DOS binary required for the BIOS. The VBIOS has been tested with version 1.7a of the Open Watcom compiler.
2. Install the Open Watcom* C/C++ compiler using the full or complete option. **Do not use the default installation option as it may cause errors when creating the BIOS in CED.**

3. Set up directory paths.
   You must set up the PATH environment variable in DOS to be able to execute the Watcom compiler. If Watcom was installed with its default path, CED will by default be able to use it.

When you generate a VBIOS, CED produces the following folders and files:

- Compiled_VBIOS folder
  - `iegdtsr.exe` (Terminate and Stay Resident executable)

    Note: `iegdtsr.exe` is available only for the US15W platform. Any description about `iegdtsr.exe` in subsequence paragraphs and sections is applicable to the US15W platform only.
  - `VGA.BIN` (Option ROM)
- `IEMGD_HEAD_VBIOS.zip` (this file is generated by the build system)

The `iegdtsr.exe` can be copied to any folder on the target machine. To run the TSR, boot the target machine with DOS, and then run the `iegdtsr.exe` from the DOS command line.

The `VGA.bin` file is the binary option ROM that can be merged with your system BIOS per the instructions provided by your system BIOS vendor.

The `IEMGD_HEAD_VBIOS.zip` file contains default builds of the TSR executable and Option ROM for the various chipsets. The filenames are `iegdtsr-def.exe` and `vga-def.bin` and are located in the `tsr` or `orom` folder of the specific chipset folder (see Figure 20). Refer to Appendix E, “Using the AMI* Video BIOS Utility” for instructions on using the command line utility to merge the VBIOS ROM image with the hardware platform system BIOS ROM image.

For further VBIOS build guidelines, see Section 4.3.3, “Building the VBIOS” on page 59.

See also the following topics:

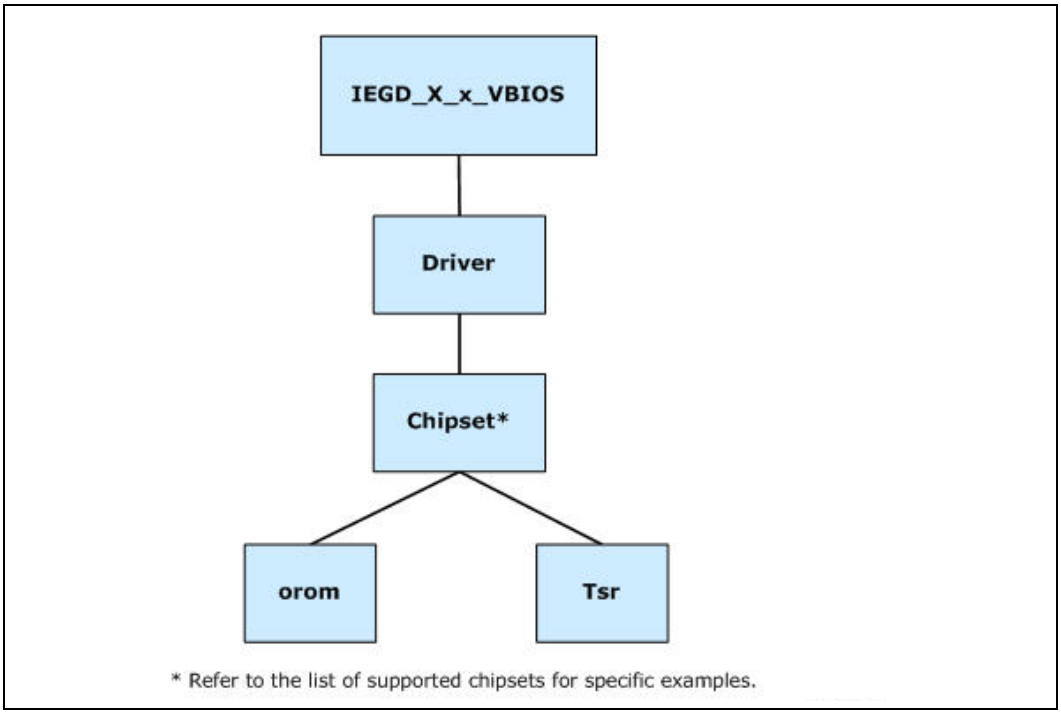
- “Selecting the Build Folder”
- “Configuring the Video BIOS”
- “Building the VBIOS”

4.3.1 Selecting the Build Folder

The 1.18 version of the VBIOS contains specific folders used for creating a VBIOS that is either an option ROM (OROM) that can be merged with the system BIOS, or an executable Terminate and Stay Resident (TSR) program for debugging purposes. There are also separate directories for the different chipsets that are supported. CED will build both the TSR and OROM.

Figure 20 shows the directory structure for the Video BIOS libraries contained within CED.

Figure 20. Video BIOS Directory Structure



4.3.2 Configuring the Video BIOS

Use CED to configure the VBIOS. Display settings will be used the same way as for the driver.

4.3.2.1 COMMON_TO_PORT

This setting allows you to associate standard display names used in most system BIOSs to specific ports that are recognized by Intel® Embedded Media and Graphics Driver (e.g., LVDS, sDVO-B). The VBIOS makes this association when the VBIOS calls the System BIOS Intel® 5F interrupt functions.

This setting is a six digit number, where each digit is associated with one of the system BIOS displays (from left to right):

1 : CRT - Standard analog CRT

2 : TV1 - TV Output 1

3 : EFP1 - DVI Flat Panel 1

4 : LFP - Local Flat Panel (Internal LVDS display)

5 : TV2 - TV Output 2

6 : EFP2 - DVI Flat Panel 2

The example values above show the typical displays and corresponding order used by a system BIOS. However, this may vary depending on how your system BIOS has implemented the displays and the Intel 5F interrupt functions.

The value in each setting associates with the port number. Using the typical settings above, set COMMON_TO_PORT to be 500400, if you want to associate CRT in the system BIOS with the internal CRT (port 5) and LFP in the system BIOS with internal LVDS (port 4) in the VBIOS.

Warning: This feature must be compatible with the system BIOS. If the system BIOS does not properly implement the Intel 5F functions, then using the `COMMON_TO_PORT` feature could cause unpredictable results with the displays. If you are unsure, set `COMMON_TO_PORT` to all zeros (000000) to disable this feature.

Note: The `displaydetect` parameter must be set to `Enabled` in order for the `COMMON_TO_PORT` values to be used.

4.3.2.2 post_display_msg

This setting is a binary setting that enables (1) or disables (0) POST messages to the display.

4.3.2.3 OEM Vendor Strings

The following settings are string values that allow you to set the values that are returned from the Intel 4F interrupt functions.

`oem_string`

`oem_vendor_name`

`oem_product_name`

`oem_product_rev`

4.3.2.4 Default Mode Settings

These settings establish the default VGA or VESA mode to use for the primary (0) and secondary (1) displays. The values should be set to a valid standard VGA or VESA mode (in hexadecimal format, for example, 0x117). Note that a VGA mode can only be set on one display and a second display is disabled unless the `DisplayConfig` parameter is set to `twin` or `clone` mode.

`default_mode_0`

`default_mode_1`

4.3.2.5 Default Refresh Settings

These settings allow you to specify which refresh rate to use for certain VESA modes on the primary and secondary displays. For example, mode 0x117 specifies refresh rates of 60 Hz, 75 Hz, and 85 Hz. This setting allows use to specify which of those three rates to use (specified in decimal, e.g., default_refresh_0=60).

`default_refresh_0`

`default_refresh_1`

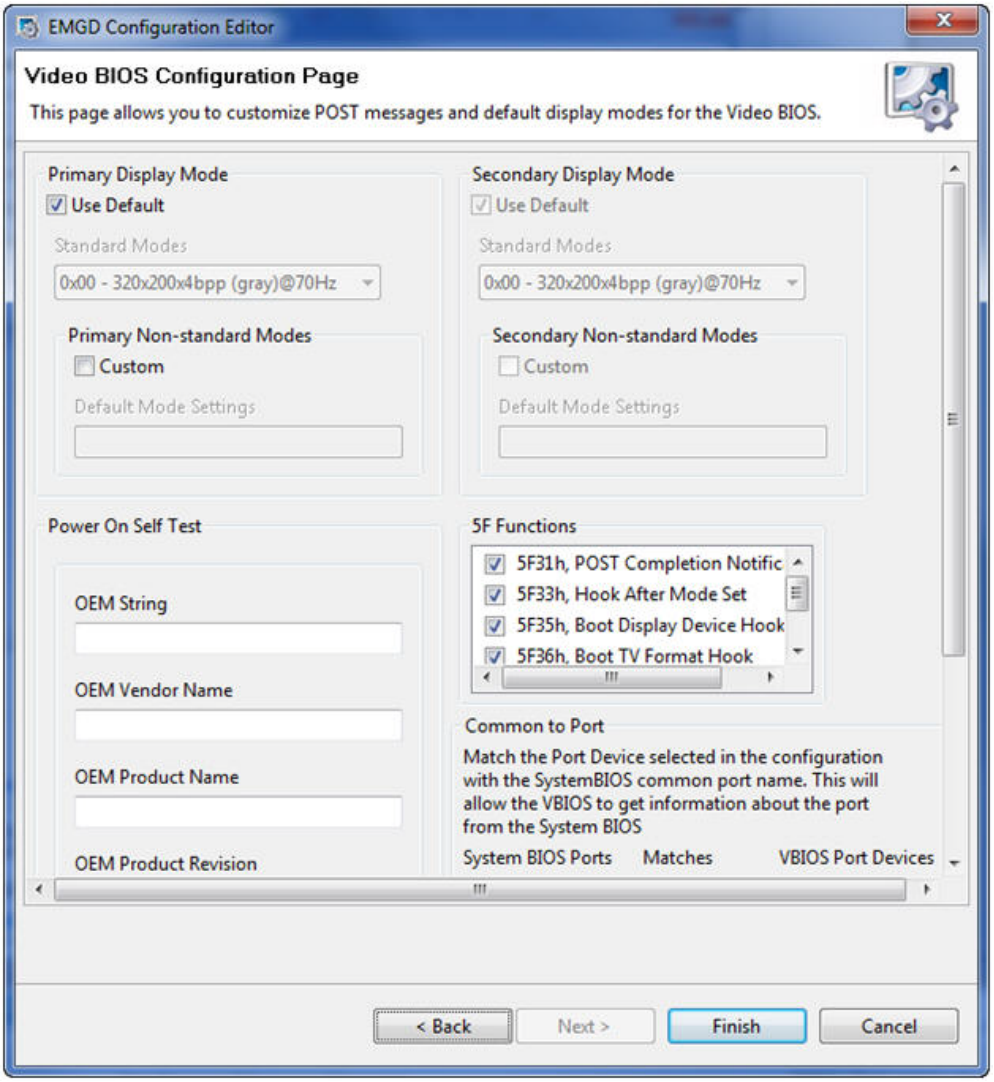
4.3.2.6 default_vga_height

This setting allows you to specify which resolution to use for certain VGA modes. Because only one VGA mode can be supported on both displays, this setting applies to the primary display mode (default_mode_0). For example, mode 3 specifies three possible resolutions: 640x200, 640x350, and 720x400. In this example, setting default_vga_height=350 indicates the resolution 640x350.

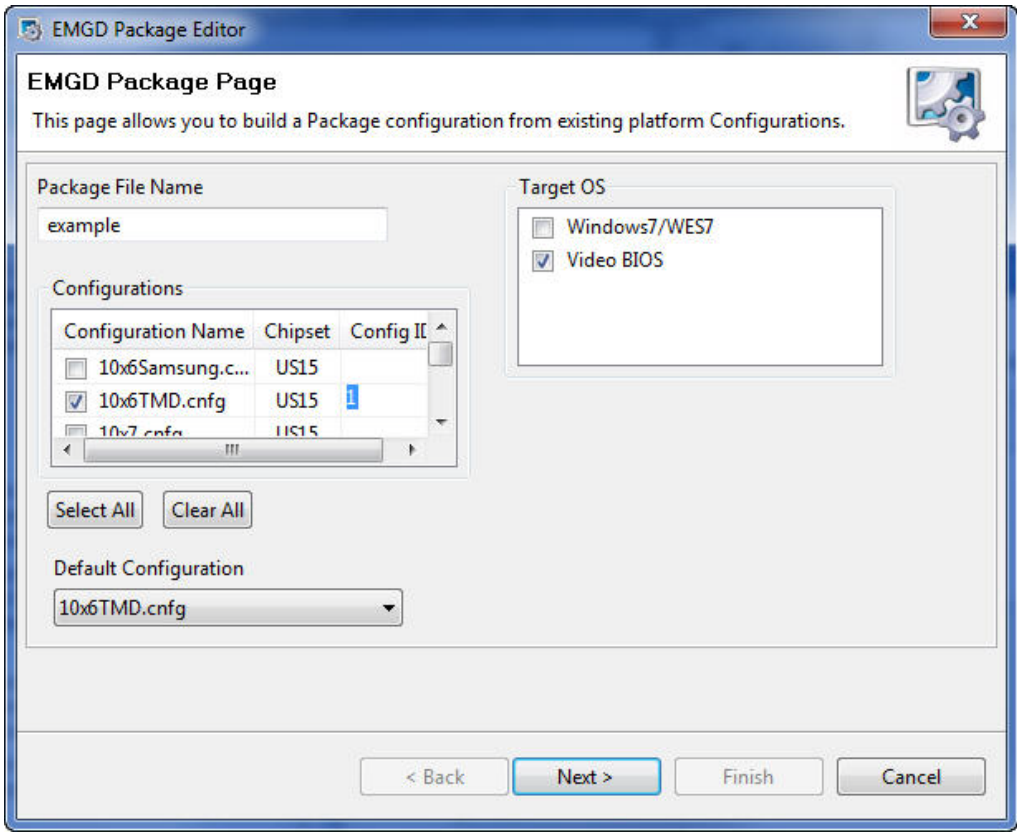
4.3.3 Building the VBIOS

CED is used to build the VBIOS. The following steps and screenshots outline a typical CED VBIOS build procedure.

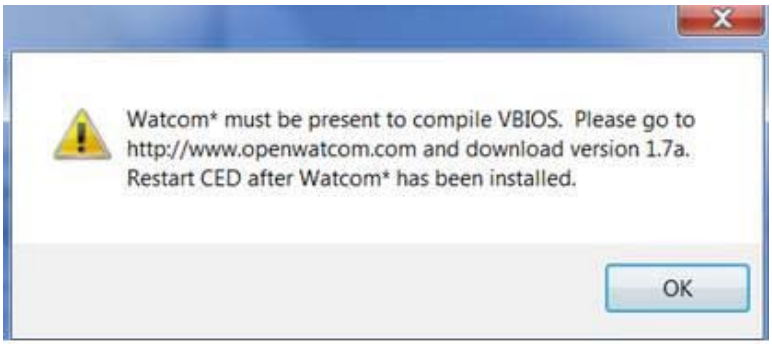
1. Define your configuration via CED, being sure to complete the Video BIOS Configuration Page.

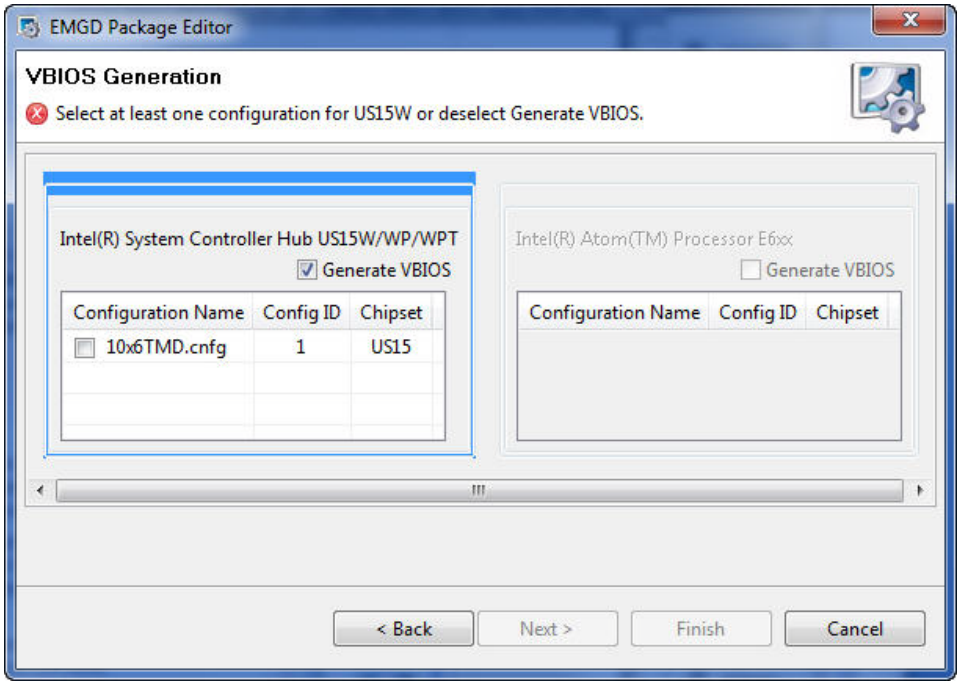

EMGD Configuration Editor
Video BIOS Configuration Page
This page allows you to customize POST messages and default display modes for the Video BIOS.
Primary Display Mode
Use Default
Standard Modes
0x00 - 320x200x4bpp (gray)@70Hz
Primary Non-standard Modes
Custom
Default Mode Settings
Secondary Display Mode
Use Default
Standard Modes
0x00 - 320x200x4bpp (gray)@70Hz
Secondary Non-standard Modes
Custom
Default Mode Settings
Power On Self Test
OEM String
OEM Vendor Name
OEM Product Name
OEM Product Revision
5F Functions
5F31h, POST Completion Notific
5F33h, Hook After Mode Set
5F35h, Boot Display Device Hook
5F36h, Boot TV Format Hook
Common to Port
Match the Port Device selected in the configuration with the SystemBIOS common port name. This will allow the VBIOS to get information about the port from the System BIOS
System BIOS Ports
Matches
VBIOS Port Devices
< Back
Next >
Finish
Cancel

2. When defining the package, be sure to select “Video BIOS” as Target OS.

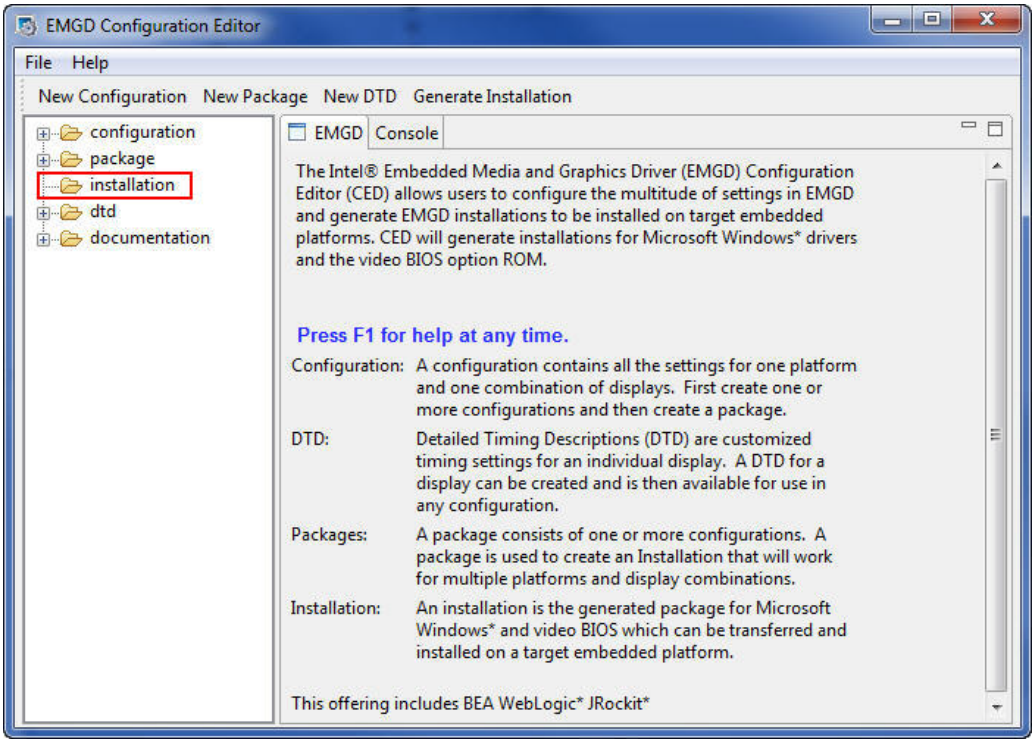


3. Generate the installation. The following message will appear if the Open Watcom* C/C++ compiler has not been installed on the user build system.


Watcom* must be present to compile VBIOS. Please go to http://www.openwatcom.com and download version 1.7a. Restart CED after Watcom* has been installed.
OK



4. Generated files should now be in your CED Installation folder.


EMGD Configuration Editor
File
Help
New Configuration
New Package
New DTD
Generate Installation
configuration
package
installation
dtd
documentation
EMGD
Console
The Intel® Embedded Media and Graphics Driver (EMGD) Configuration Editor (CED) allows users to configure the multitude of settings in EMGD and generate EMGD installations to be installed on target embedded platforms. CED will generate installations for Microsoft Windows* drivers and the video BIOS option ROM.
Press F1 for help at any time.
Configuration: A configuration contains all the settings for one platform and one combination of displays. First create one or more configurations and then create a package.
DTD: Detailed Timing Descriptions (DTD) are customized timing settings for an individual display. A DTD for a display can be created and is then available for use in any configuration.
Packages: A package consists of one or more configurations. A package is used to create an Installation that will work for multiple platforms and display combinations.
Installation: An installation is the generated package for Microsoft Windows* and video BIOS which can be transferred and installed on a target embedded platform.
This offering includes BEA WebLogic* JRockit*

4.4 VBIOS, Driver Compatibility, and Data Dependencies

The Intel® Embedded Media and Graphics Driver does not depend on any data from the VBIOS, and will either use driver settings or select default values for the attached displays. This allows the driver to properly operate with incompatible BIOS or BIOS replacements.

The Intel® Embedded Media and Graphics Driver will retrieve settings, such as panel ID and other display settings from the Embedded VBIOS. The Embedded VBIOS can configure display timings that can also be used for the Intel® Embedded Media and Graphics Driver.

In the current release, Intel® EMGD supports only pre-configured 10x7 resolution and EDID-detected 13x7 resolutions on an internal LVDS panel.

4.4.1 VESA and VGA Video Modes

The VBIOS supports many VESA and standard VGA modes. See Table 19 and Table 20 for the VGA and VESA modes and vertical refresh rates that are supported by the VBIOS.

Note: Although IBM labeled certain EGA modes with a (*) suffix and the VGA modes with a (+) suffix (such as mode 3, 3* and 3+), the VGA modes are so common that this document does not use the (+) suffix to refer to them.

The actual availability of any particular mode depends on the capabilities of the display device, the amount of memory installed, and other system parameters.

Table 19. Supported VGA Video Display Modes (Sheet 1 of 2)

Video Mode	Pixel Resolution	Color Depth (bpp)	Mode Type	Display Adapter	Font Size	Character Resolution	Dot Clock (MHz)	Horiz. Freq. (KHz)	Vert Freq (Hz)	Video Memory (KBytes)
00h	320 x 200	16 (gray) (4 bpp)	Text	CGA	8 x 8	40 x 25	25	31.5	70	256
	320 x 350	16 (gray) (4 bpp)		EGA	8 x 14	40 x 25	25	31.5	70	256
	360 x 400	16 (4 bpp)		VGA	9 x 16	40 x 25	28	31.5	70	256
01h	320 x 200	16 (4 bpp)	Text	CGA	8 x 8	40 x 25	25	31.5	70	256
	320 x 350	16 (4 bpp)		EGA	8 x 14	40 x 25	25	31.5	70	256
	360 x 400	16 (4 bpp)		VGA	9 x 16	40 x 25	28	31.5	70	256
02h	640 x 200	16 (gray) (4 bpp)	Text	CGA	8 x 8	80 x 25	25	31.5	70	256
	640 x 350	16 (gray) (4 bpp)		EGA	8 x 14	80 x 25	25	31.5	70	256
	720 x 400	16 (4 bpp)		VGA	9 x 16	80 x 25	28	31.5	70	256

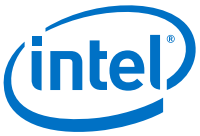


Table 19. Supported VGA Video Display Modes (Sheet 2 of 2)

Video Mode	Pixel Resolution	Color Depth (bpp)	Mode Type	Display Adapter	Font Size	Character Resolution	Dot Clock (MHz)	Horiz. Freq. (KHz)	Vert Freq (Hz)	Video Memory (KBytes)
03h	640 x 200	16 (4 bpp)	Text	CGA	8 x 8	80 x 25	25	31.5	70	256
	640 x 350	16 (4 bpp)		EGA	8 x 14	80 x 25	25	31.5	70	256
	720 x 400	16 (4 bpp)		VGA	9 x 16	80 x 25	28	31.5	70	256
04h	320 x 200	4	Graph	All	8 x 8	40 x 25	25	31.5	70	256
05h	320 x 200	4 (gray)	Graph	CGA	8 x 8	40 x 25	25	31.5	70	256
	320 x 200	4 (gray)		EGA	8 x 8	40 x 25	25	31.5	70	256
	320 x 200	4		VGA	8 x 8	40 x 25	25	31.5	70	256
06h	640 x 200	2	Graph	All	8 x 8	80 x 25	25	31.5	70	256
07h	720 x 350	Mono	Text	MDA	9 x 14	80 x 25	28	31.5	70	256
	720 x 350	Mono		EGA	9 x 14	80 x 25	28	31.5	70	256
	720 x 400	Mono		VGA	9 x 16	80 x 25	28	31.5	70	256
08h-0Ch	Reserved			-		-				
0Dh	320 x 200	16 (4 bpp)	Graph	E/VGA	8 x 8	40 x 25	25	31.5	70	256
0Eh	640 x 200	16 (4 bpp)	Graph	E/VGA	8 x 8	80 x 25	25	31.5	70	256
0Fh	640 x 350	Mono	Graph	E/VGA	8 x 14	80 x 25	25	31.5	70	256
10h	640 x 350	16 (4 bpp)	Graph	E/VGA	8 x 14	80 x 25	25	31.5	70	256
11h	640 x 480	2 (4 bpp)	Graph	VGA	8 x 16	80 x 30	25	31.5	60	256
12h	640 x 480	16 (4 bpp)	Graph	VGA	8 x 16	80 x 30	25	31.5	60	256
13h	320 x 200	256 (8 bpp)	Graph	VGA	8 x 8	40 x 25	25	31.5	70	256

Table 20. VESA Modes Supported by Video BIOS (Sheet 1 of 2)

Video Mode	Pixel Resolution	Colors (bpp)	Mode Type	Display Adapter	Vertical Frequency (Hz)	Video Memory (MB)
101h	640 x 480	256 (8 bpp)	Graph	VGA	60	0.5
	640 x 480	256 (8 bpp)	Graph	VGA	75	0.5
	640 x 480	256 (8 bpp)	Graph	VGA	85	0.5
103h	800 x 600	256 (8 bpp)	Graph	SVGA	60	1
	800 x 600	256 (8 bpp)	Graph	SVGA	75	1
	800 x 600	256 (8 bpp)	Graph	SVGA	85	1
105h	1024 x 768	256 (8 bpp)	Graph	XVGA	60	1
	1024 x 768	256 (8 bpp)	Graph	XVGA	75	1
	1024 x 768	256 (8 bpp)	Graph	XVGA	85	1
107h	1280 x 1024	256 (8 bpp)	Graph	SXGA	60	2
	1280 x 1024	256 (8 bpp)	Graph	SXGA	75	2
	1280 x 1024	256 (8 bpp)	Graph	SXGA	85	2
111h	640 x 480	64K (16 bpp)	Graph	VGA	60	1
	640 x 480	64K (16 bpp)	Graph	VGA	75	1
	640 x 480	64K (16 bpp)	Graph	VGA	85	1
114h	800 x 600	64K (16 bpp)	Graph	SVGA	60	2
	800 x 600	64K (16 bpp)	Graph	SVGA	75	2
	800 x 600	64K (16 bpp)	Graph	SVGA	85	2
117h	1024 x 768	64K (16 bpp)	Graph	XVGA	60	2
	1024 x 768	64K (16 bpp)	Graph	XVGA	75	2
	1024 x 768	64K (16 bpp)	Graph	XVGA	85	2

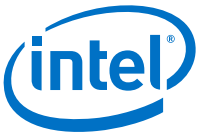


Table 20. VESA Modes Supported by Video BIOS (Sheet 2 of 2)

Video Mode	Pixel Resolution	Colors (bpp)	Mode Type	Display Adapter	Vertical Frequency (Hz)	Video Memory (MB)
11Ah	1280 x 1024	64K (16 bpp)	Graph	SXGA	60	4
	1280 x 1024	64K (16 bpp)	Graph	SXGA	75	4
	1280 x 1024	64K (16 bpp)	Graph	SXGA	85	4
112	640 x 480	16M (32 bpp)	Graph	VGA	60	2
	640 x 480	16M (32 bpp)	Graph	VGA	75	2
	640 x 480	16M (32 bpp)	Graph	VGA	85	2
115	800 x 600	16M (32 bpp)	Graph	SVGA	60	4
	800 x 600	16M (32 bpp)	Graph	SVGA	75	4
	800 x 600	16M (32 bpp)	Graph	SVGA	85	4
118	1024 x 768	16M (32 bpp)	Graph	XVGA	60	4
	1024 x 768	16M (32 bpp)	Graph	XVGA	75	4
	1024 x 768	16M (32 bpp)	Graph	XVGA	85	4
11B	1280 x 1024	16M (32 bpp)	Graph	SXGA	60	8
	1280 x 1024	16M (32 bpp)	Graph	SXGA	75	8
	1280 x 1024	16M (32 bpp)	Graph	SXGA	85	8

Notes: Clone mode is not supported in VBIOS for Atom E6xx.

A single config ID can have multiple port drivers. However, only one display will be activated based on port order priority.

§ §

5.0 Configuring and Installing Microsoft Windows Drivers

5.1 Editing the Microsoft Windows INF File

This section describes the driver-level information (`igdlh32.inf`) for the Microsoft Windows* operating system, which includes the following:

- Microsoft Windows* 7
- Microsoft Windows* Embedded Standard 7

Note: Windows* Embedded Standard 7 configuration allows the INF update ONLY from CED. This editing is error prone and should be avoided.

5.2 Configuration Information

5.2.1 Universal INF Configuration

One INF file can specify multiple display configurations. A ConfigId parameter uniquely identifies each configuration.

The driver reads the PanelId from the System BIOS during initialization and uses the configuration whose ConfigId matches the PanelId. If the System BIOS does not set a valid PanelId (for example, panelId = 0), the driver reads a configuration using ConfigId = 1. (A ConfigId value of 0 is invalid.)

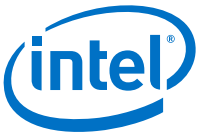
Note: When setting up a multiple display configuration to be used with the PanelID, do not set a default configuration. To have no default configuration, select **None** from the Default Configuration drop-down menu on the EMGD Package Page. See Section 3.6, "Creating a New Package" on page 36 for details.

You can override the default behavior by specifying a ConfigId parameter as follows:

```
HKR,, ConfigId, %REG_DWORD%, %DEFAULT_CONFIG_ID%
```

In this case, the driver ignores the PanelId returned by the System BIOS. Instead, the Intel® Embedded Media and Graphics Driver uses the configuration information using the specified ConfigId.

The `PcfVersion` key is generated automatically by the CED utility and is placed in the `[iegd_SoftwareDeviceSettings]` section of the `.inf` file. The default `igdlh32.inf` file already contains the `PcfVersion` key. Please see Appendix D, "Example INF File" to view a sample `.inf` file.



5.2.2 Dual Panel Configuration

Below are the settings required to set the INF file to enable extended display configurations. Typically, these settings are output from the CED utility. However, the INF file may also be edited directly. See Table 21 for a description of these settings.

```
HKR, Config\%DEFAULT_CONFIG_ID%\General, DisplayConfig, %REG_DWORD%, 8
HKR, Config\%DEFAULT_CONFIG_ID%\General, PortOrder, %REG_SZ%, "52000"
```

5.2.3 Chipset Dual Display Example

The table below presents the dual display example for an Intel chipset.

Table 21. Example of Chipset Dual Display Parameter Setting

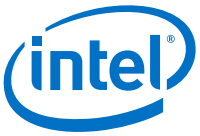
Dual Display Combination	Port Order
Internal LVDS + sDVOB	“42000”
sDVOB + Internal LVDS	“24000”

5.2.4 Creating Registry Settings for Graphics Driver INF File

Use CED to configure the driver settings. It generates the following output, which is then inserted into the graphics driver INF file before driver installation. CED simply translates the configuration options to the INF file. See Table 17, “Parameter Configuration Format” on page 43 for details on the specific settings and values, which also apply to the settings and values of the INF file. The values of the INF file may also be directly modified. See the example below for syntax and usage. Also, see Appendix D, “Example INF File” for a complete sample INF file.

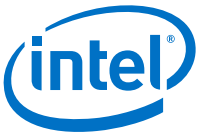
```
;;============================================================================
;
; Copyright (c) Intel Corporation (2013).
;
; INTEL MAKES NO WARRANTY OF ANY KIND REGARDING THE CODE.  THIS CODE IS
; LICENSED ON AN "AS IS" BASIS AND INTEL WILL NOT PROVIDE ANY SUPPORT,
; ASSISTANCE, INSTALLATION, TRAINING OR OTHER SERVICES.  INTEL DOES NOT
; PROVIDE ANY UPDATES, ENHANCEMENTS OR EXTENSIONS.  INTEL SPECIFICALLY
; DISCLAIMS ANY WARRANTY OF MERCHANTABILITY, NONINFRINGEMENT, FITNESS FOR ANY
; PARTICULAR PURPOSE, OR ANY OTHER WARRANTY.  Intel disclaims all liability,
; including liability for infringement of any proprietary rights, relating to
; use of the code. No license, express or implied, by estoppel or otherwise,
; to any intellectual property rights is granted herein.
;
;============================================================================

;============================================================================
; Installation inf for the Intel Corporation graphics adapter.
[Version]
Signature="$WINDOWS NT$"
Provider=%Intel%
ClassGUID={4D36E968-E325-11CE-BFC1-08002BE10318}
Class=Display
;8.14.xx.xxxx Win7 & later DX9
;8.15.xx.xxxx Win7 & DX10
DriverVer=03/10/2011,8.14.180.1889
;CatalogFile=Poulsbo.cat  ; required for WHQL digital signature

;============================================================================
[DestinationDirs]
DefaultDestDir   = 11
igd.Miniport  = 12  ; drivers
```

```
igd.UserMode  = 11  ; system32
igd.ICD       = 11  ; system32
igd.MSDK  = 11  ; system32
CUI.Copy = 11
OPM.Copy = 11
Resource.Copy = 11 ; system32

;=============================================================================
;
; Driver information
;

;=============================================================================
[Manufacturer]
%Intel%   = Intel.Mfg,NTx86.6.1

;=============================================================================
;[Intel.Mfg]
; Leave this blank since we don't support anything other than 32-bit Win7

[Intel.Mfg.NTx86.6.1] ;32-bit Win7
%Intel% %i900G0%  = igd_plb, PCI\VEN_8086&DEV_8108
%Intel% %iTNC0%   = igd_tnc, PCI\VEN_8086&DEV_4108

;=============================================================================
[igd_plb.GeneralConfigData]
MaximumNumberOfDevices = 2
MaximumDeviceMemoryConfiguration = 256

;=============================================================================
[igd_tnc.GeneralConfigData]
MaximumNumberOfDevices = 2
MaximumDeviceMemoryConfiguration = 256

;=============================================================================
;
; General installation section
;
;=============================================================================
[igd_plb]
FeatureScore=F6   ; required for WDDM
CopyFiles = igd.Miniport, igd.UserMode, igd.ICD, CUI.Copy, OPM.Copy, Resource.Copy
AddReg = igd_SoftwareDeviceSettings_plb, CUI.AddReg
DelReg = igd_SoftwareDeviceSettings_plb, CUI.DelReg
RegisterDlls = CUISDK_Registration

;=============================================================================
[igd_tnc]
FeatureScore=F6   ; required for WDDM
CopyFiles = igd.Miniport, igd.UserMode, igd.ICD, igd.MSDK, CUI.Copy, OPM.Copy,
Resource.Copy
AddReg = igd_SoftwareDeviceSettings_tnc, CUI.AddReg
DelReg = igd_SoftwareDeviceSettings_tnc, CUI.DelReg
RegisterDlls = CUISDK_Registration


;=============================================================================
;
; File sections
;
[igd.Miniport]
igdkmd32.sys

[igd.UserMode]
igdumd32.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
```



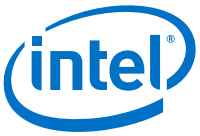
```
[igd.ICD]
igdsgl32.dll
igdogl32.dll

[igd.MSDK]
libmfxhw32.dll

[OPM.Copy]
igdkmd32.vp
igd_XC.vp
igd_XO.vp
igd_XA.cpa
igd_XA.vp

[CUI.Copy]
hccutils.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxsrvc.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxsrvc.exe,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxpph.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxcpl.cpl,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxcfg.exe,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxdo.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxtray.exe,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
hkcmd.exe,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxres.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxress.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME     ; Generic language
resource file
IgfxExtps.dll,,,0x00004000 ; COPYFLG_IN_USE_TRY_RENAME
IgfxExt.exe,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME

[Resource.Copy]
igfxrENU.lrc
igfxressENU.lrc

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
[CUI.DelReg]
HKLM,%CUIDeviceIndependentKey%
HKLM,%DisplayKey%
; Delete old style cui keys which are device dependent
HKLM,Software\INTEL\igfxcui
HKR,igfxcfg
HKR,igfxcpl
HKR,igfxpph
HKR,igfxsrvc
HKR,igfxhk
HKR,hkcmd
HKR,igfxtray
HKR,shellex\PropertySheetHandlers

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
; Delete the CUI registry entry which registers for winlogon events
;
HKLM,"SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon\Notify\igfxcui"

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;CUIService

HKCR,"igfx.CUIService\CLSID"
HKCR,"igfx.CUIService\CurVer"
HKCR,"igfx.CUIService"
HKCR,"igfx.CUIService.1\CLSID"
HKCR,"igfx.CUIService.1"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}\InProcServer32\ThreadingModel"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}\InProcServer32"
```

```
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}\ProgID"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}\Programmable"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}\VersionIndependentProgID"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}"

;=============================================================================
;igfxhk.Hotkey

HKCR,"igfxhk.HotKey\CLSID"
HKCR,"igfxhk.HotKey\CurVer"
HKCR,"igfxhk.HotKey"
HKCR,"igfxhk.HotKey.1\CLSID"
HKCR,"igfxhk.HotKey.1"
HKCR,"CLSID\{235CC099-CFB4-44D9-8228-270FEE479D8A}\InProcServer32\ThreadingModel"
HKCR,"CLSID\{235CC099-CFB4-44D9-8228-270FEE479D8A}\InProcServer32"
HKCR,"CLSID\{235CC099-CFB4-44D9-8228-270FEE479D8A}\ProgID"
HKCR,"CLSID\{235CC099-CFB4-44D9-8228-270FEE479D8A}\VersionIndependentProgID"
HKCR,"CLSID\{235CC099-CFB4-44D9-8228-270FEE479D8A}"

;=============================================================================
;Remove HKLM\Software\Microsoft\Windows\Currentversion\Run CUI entries
HKLM,"SOFTWARE\Microsoft\Windows\CurrentVersion\Run","HotKeysCmds"
HKLM,"SOFTWARE\Microsoft\Windows\CurrentVersion\Run","IgfxTray"
HKLM,"SOFTWARE\Microsoft\Windows\CurrentVersion\Run","IgfxExt"

;=============================================================================
;
; Service Installation
;
[igd_plb.Services]
AddService = igd, 0x00000002, igd_Service_Inst, igd_EventLog_Inst

[igd_tnc.Services]
AddService = igd, 0x00000002, igd_Service_Inst, igd_EventLog_Inst


;=============================================================================
[igd_Service_Inst]
ServiceType    = 1               ; SERVICE_KERNEL_DRIVER
StartType      = 3               ; SERVICE_DEMAND_START
ErrorControl   = 0                ; SERVICE_ERROR_IGNORE
LoadOrderGroup = Video
ServiceBinary  = %12%\igdkmd32.sys

;=============================================================================
[igd_EventLog_Inst]
AddReg = igd_EventLog_AddReg

;=============================================================================
[igd_EventLog_AddReg]
HKR,,EventMessageFile,0x00020000,"%SystemRoot%"\System32\IoLogMsg.dll;%SystemRoot%
"\System32\drivers\igdkmd32.sys"
HKR,,TypesSupported,0x00010001,7D3D

;=============================================================================
;
; Software Installation
;
[igd_SoftwareDeviceSettings_plb]
HKR,, UserModeDriverName,    %REG_MULTI_SZ%, igdumd32.dll
HKR,, InstalledDisplayDrivers,    %REG_MULTI_SZ%, igdumd32
HKR,, UserModeDriverGUID,  %REG_SZ%,{"A37D3D79-C3DB-4270-A0D6-72F8AB8F511D"}
HKLM, "SYSTEM\CurrentControlSet\Control\GraphicsDrivers",  UseXPModel,
%REG_DWORD%,  0
HKR,, OpenGLDriverName,            %REG_MULTI_SZ%, igdogl32.dll
HKR,, OpenGLVersion,               %REG_DWORD%,    1
HKR,, OpenGLFlags,                 %REG_DWORD%,    1
```



```
HKR,, PcfVersion,    %REG_DWORD%, 0x0700

HKR,, ConfigId, %REG_DWORD%, 1

HKR, ALL\1 , name, %REG_SZ%, "US15"
HKR, ALL\1\General , DisplayConfig, %REG_DWORD%, 1
HKR, ALL\1\General , PortOrder, %REG_SZ%, "24000"
HKR, ALL\1\Port\4\General , name, %REG_SZ%, "LVDS10x7"
HKR, ALL\1\Port\4\General , Rotation, %REG_DWORD%, 0
HKR, ALL\1\Port\4\General , Edid, %REG_DWORD%, 1
HKR, ALL\1\Port\4\General , EdidAvail, %REG_DWORD%, 3
HKR, ALL\1\Port\4\General , EdidNotAvail, %REG_DWORD%, 4
HKR, ALL\1\Port\4\FpInfo , bkltmethod, %REG_DWORD%, 1
HKR, ALL\1\Port\4\FpInfo , BkltT1, %REG_DWORD%, 60
HKR, ALL\1\Port\4\FpInfo , BkltT2, %REG_DWORD%, 200
HKR, ALL\1\Port\4\FpInfo , BkltT3, %REG_DWORD%, 200
HKR, ALL\1\Port\4\FpInfo , BkltT4, %REG_DWORD%, 50
HKR, ALL\1\Port\4\FpInfo , BkltT5, %REG_DWORD%, 400
HKR, ALL\1\Port\4\Dtd\1 , PixelClock, %REG_DWORD%, 65000
HKR, ALL\1\Port\4\Dtd\1 , HorzActive, %REG_DWORD%, 1024
HKR, ALL\1\Port\4\Dtd\1 , HorzSync, %REG_DWORD%, 24
HKR, ALL\1\Port\4\Dtd\1 , HorzSyncPulse, %REG_DWORD%, 136
HKR, ALL\1\Port\4\Dtd\1 , HorzBlank, %REG_DWORD%, 320
HKR, ALL\1\Port\4\Dtd\1 , VertActive, %REG_DWORD%, 768
HKR, ALL\1\Port\4\Dtd\1 , VertSync, %REG_DWORD%, 3
HKR, ALL\1\Port\4\Dtd\1 , VertSyncPulse, %REG_DWORD%, 6
HKR, ALL\1\Port\4\Dtd\1 , VertBlank, %REG_DWORD%, 38
HKR, ALL\1\Port\4\Dtd\1 , Flags, %REG_DWORD%, 0x20000
HKR, ALL\1\Port\4\Attr , 27, %REG_DWORD%, 0
HKR, ALL\1\Port\4\Attr , 26, %REG_DWORD%, 18
HKR, ALL\1\Port\2\General , name, %REG_SZ%, "SDVOB"
HKR, ALL\1\Port\2\General , Rotation, %REG_DWORD%, 0
HKR, ALL\1\Port\2\General , Edid, %REG_DWORD%, 1
HKR, ALL\1\Port\2\General , EdidAvail, %REG_DWORD%, 3
HKR, ALL\1\Port\2\General , EdidNotAvail, %REG_DWORD%, 4

;=============================================================================
[igd_SoftwareDeviceSettings_tnc]
HKR,, UserModeDriverName,    %REG_MULTI_SZ%, igdumd32.dll
HKR,, InstalledDisplayDrivers,    %REG_MULTI_SZ%, igdumd32
HKR,, UserModeDriverGUID,  %REG_SZ%,{"A37D3D79-C3DB-4270-A0D6-72F8AB8F511D"}
HKLM, "SYSTEM\CurrentControlSet\Control\GraphicsDrivers",  UseXPModel,
%REG_DWORD%,  0
HKR,, OpenGLDriverName,            %REG_MULTI_SZ%, igdogl32.dll
HKR,, OpenGLVersion,               %REG_DWORD%,    1
HKR,, OpenGLFlags,                 %REG_DWORD%,    1

HKR,, MSDKLib,            %REG_MULTI_SZ%, libmfxhw32.dll

HKR,, PcfVersion,    %REG_DWORD%, 0x0700

HKR,, ConfigId, %REG_DWORD%, 1

HKR, ALL\1 , name, %REG_SZ%, "Atom_E6xx_13X7"
HKR, ALL\1\General , DisplayConfig, %REG_DWORD%, 1
HKR, ALL\1\General , PortOrder, %REG_SZ%, "42000"
HKR, ALL\1\Port\4\General , name, %REG_SZ%, "LVDS13x7"
HKR, ALL\1\Port\4\General , Rotation, %REG_DWORD%, 0
HKR, ALL\1\Port\4\General , Edid, %REG_DWORD%, 1
HKR, ALL\1\Port\4\General , EdidAvail, %REG_DWORD%, 3
HKR, ALL\1\Port\4\General , EdidNotAvail, %REG_DWORD%, 4
HKR, ALL\1\Port\4\FpInfo , bkltmethod, %REG_DWORD%, 1
HKR, ALL\1\Port\4\FpInfo , BkltT1, %REG_DWORD%, 60
HKR, ALL\1\Port\4\FpInfo , BkltT2, %REG_DWORD%, 200
HKR, ALL\1\Port\4\FpInfo , BkltT3, %REG_DWORD%, 200
HKR, ALL\1\Port\4\FpInfo , BkltT4, %REG_DWORD%, 50
```

```
HKR, ALL\1\Port\4\FpInfo , BkltT5, %REG_DWORD%, 400
HKR, ALL\1\Port\4\Dtd\1 , PixelClock, %REG_DWORD%, 72300
HKR, ALL\1\Port\4\Dtd\1 , HorzActive, %REG_DWORD%, 1366
HKR, ALL\1\Port\4\Dtd\1 , HorzSync, %REG_DWORD%, 48
HKR, ALL\1\Port\4\Dtd\1 , HorzSyncPulse, %REG_DWORD%, 32
HKR, ALL\1\Port\4\Dtd\1 , HorzBlank, %REG_DWORD%, 160
HKR, ALL\1\Port\4\Dtd\1 , VertActive, %REG_DWORD%, 768
HKR, ALL\1\Port\4\Dtd\1 , VertSync, %REG_DWORD%, 3
HKR, ALL\1\Port\4\Dtd\1 , VertSyncPulse, %REG_DWORD%, 5
HKR, ALL\1\Port\4\Dtd\1 , VertBlank, %REG_DWORD%, 22
HKR, ALL\1\Port\4\Dtd\1 , Flags, %REG_DWORD%, 0x20000
HKR, ALL\1\Port\4\Attr , 27, %REG_DWORD%, 0
HKR, ALL\1\Port\4\Attr , 26, %REG_DWORD%, 18
HKR, ALL\1\Port\4\Attr , 60, %REG_DWORD%, 1
HKR, ALL\1\Port\4\Attr , 70, %REG_DWORD%, 100
HKR, ALL\1\Port\4\Attr , 71, %REG_DWORD%, 20300
HKR, ALL\1\Port\2\General , name, %REG_SZ%, "SDVOB"
HKR, ALL\1\Port\2\General , Rotation, %REG_DWORD%, 0
HKR, ALL\1\Port\2\General , Edid, %REG_DWORD%, 1
HKR, ALL\1\Port\2\General , EdidAvail, %REG_DWORD%, 3
HKR, ALL\1\Port\2\General , EdidNotAvail, %REG_DWORD%, 4

;=============================================================================
;
; Source file information
;
[SourceDisksNames.x86]
1 = %DiskId%,,,""

[SourceDisksFiles]
igdkmd32.sys  = 1
igdumd32.dll = 1

igdsgl32.dll = 1
igdogl32.dll =1

libmfxhw32.dll = 1

igdkmd32.vp = 1
igd_XC.vp = 1
igd_XO.vp = 1
igd_XA.cpa = 1
igd_XA.vp = 1

hccutils.dll = 1
igfxsrvc.dll = 1
igfxsrvc.exe = 1
igfxpph.dll = 1
igfxcpl.cpl = 1
igfxcfg.exe = 1
igfxdo.dll = 1
igfxtray.exe = 1
hkcmd.exe = 1
igfxres.dll = 1
igfxress.dll = 1; Generic language resource file
IgfxExtps.dll = 1
IgfxExt.exe = 1

igfxrENU.lrc = 1

igfxressENU.lrc = 1

;=============================================================================
[CUI.AddReg]
;Add INTEL/CUI keys
HKLM,"Software\INTEL"
HKLM,%DisplayKey%
```

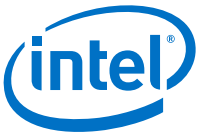


```
HKLM,%CUIDeviceIndependentKey%

; Device Independent registry location
HKCR,"CLSID\{280A8F40-E382-11D2-B561-00A0C92E6848}",,,%CUIDeviceIndependentKey%

; Add Diagnostic Pages with the rest of the pages
;fixme
HKLM,"SOFTWARE\Microsoft\Windows\CurrentVersion\Controls
Folder\Display\shellex\PropertySheetHandlers\igfxcui",,,"{3AB1675A-CCFF-11D2-8B20-
00A0C93CB1F4}"

; Store resource information under %CUIDeviceIndependentKey%
; Control panel resource
HKLM,"%CUIDeviceIndependentKey%\igfxcpl\resources","468",,%11%"\igfxcfg.exe"
; static pages resource
HKLM,"%CUIDeviceIndependentKey%\igfxpph\resources","468",,%11%"\igfxcfg.exe"
; cfg resource
HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","468",,%11%"\igfxcfg.exe"
HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","829",,""
; service resource
HKLM,"%CUIDeviceIndependentKey%\igfxsrvc\resources","468",,%11%"\igfxcfg.exe"
; tray resource
HKLM,"%CUIDeviceIndependentKey%\igfxtray\resources","468",,%11%"\igfxcfg.exe"
HKLM,"%CUIDeviceIndependentKey%\igfxtray\resources","467",,%11%"\igfxtray.exe"
HKLM,"%CUIDeviceIndependentKey%\igfxtray\TrayIcon","ShowTrayIcon",%REG_DWORD%,1
; hotkey resource
HKLM,"%CUIDeviceIndependentKey%\hkcmd\resources","468",,%11%"\igfxcfg.exe"
;static pages resource
HKLM,"%CUIDeviceIndependentKey%\igfxpph\resources","467",,%11%"\igfxtray.exe"

; Context menu handler entry.
HKCR, "Directory\Background\shellex\ContextMenuHandlers\igfxcui",,,"{3AB1675A-
CCFF-11D2-8B20-00A0C93CB1F4}"
;
; Registration of CUI dll's:            These will not self-register through the
have-disk install.
;                                       Does not register TypeLibs or Interfaces.
;
; igfxcfg.exe self registration entries
;
HKCR,"AppID\{3D62E9A1-D243-11D2-B561-00A0C92E6848}",,,"igfxcfg"
HKCR,"AppID\igfxcfg.EXE","AppID",,"{3D62E9A1-D243-11D2-B561-00A0C92E6848}"
HKCR,"CLSID\{A354BD60-4C0A-11d3-B561-00A0C92E6848}",,,"DataObject Class"
HKCR,"CLSID\{A354BD60-4C0A-11d3-B561-00A0C92E6848}","AppID",,"{3D62E9A1-D243-11D2-
B561-00A0C92E6848}"
HKCR,"CLSID\{A354BD60-4C0A-11d3-B561-
00A0C92E6848}\ProgID",,,"igfxcfg.DataObject.1"
HKCR,"CLSID\{A354BD60-4C0A-11d3-B561-
00A0C92E6848}\VersionIndependentProgID",,,"igfxcfg.DataObject"
HKCR,"CLSID\{A354BD60-4C0A-11d3-B561-
00A0C92E6848}\LocalServer32",,,%11%"\igfxcfg.exe"
HKCR,"CLSID\{EE2D6561-D63C-11D2-B561-00A0C92E6848}",,,"ShellExt Class"
HKCR,"CLSID\{EE2D6561-D63C-11D2-B561-00A0C92E6848}","AppID",,"{3D62E9A1-D243-11D2-
B561-00A0C92E6848}"
HKCR,"CLSID\{EE2D6561-D63C-11D2-B561-00A0C92E6848}\ProgID",,,"igfxcfg.ShellExt.1"
HKCR,"CLSID\{EE2D6561-D63C-11D2-B561-
00A0C92E6848}\VersionIndependentProgID",,,"igfxcfg.ShellExt"
HKCR,"CLSID\{EE2D6561-D63C-11D2-B561-00A0C92E6848}\Programmable",,,
HKCR,"CLSID\{EE2D6561-D63C-11D2-B561-
00A0C92E6848}\LocalServer32",,,%11%"\igfxcfg.exe"
HKCR,"igfxcfg.DataObject.1",,,"DataObject Class"
HKCR,"igfxcfg.DataObject.1\CLSID",,,"{A354BD60-4C0A-11d3-B561-00A0C92E6848}"
HKCR,"igfxcfg.DataObject",,,"DataObject Class"
HKCR,"igfxcfg.DataObject\CurVer",,,"igfxcfg.DataObject.1"
HKCR,"igfxcfg.DataObject\CLSID",,,"{A354BD60-4C0A-11d3-B561-00A0C92E6848}"
HKCR,"igfxcfg.ShellExt.1",,,"ShellExt Class"
HKCR,"igfxcfg.ShellExt.1\CLSID",,,"{EE2D6561-D63C-11D2-B561-00A0C92E6848}"
```

```
HKCR,"igfxcfg.ShellExt",,,"ShellExt Class"
HKCR,"igfxcfg.ShellExt\CurVer",,,"igfxcfg.ShellExt.1"
HKCR,"igfxcfg.ShellExt\CLSID",,,"{EE2D6561-D63C-11D2-B561-00A0C92E6848}"

;
; igfxsrvc.exe self registration entries
;
HKCR,"igfxsrvc.Settings\CLSID",,,"{078AEF33-C48A-49F7-AFF3-A0EE810BFE7C}"
HKCR,"igfxsrvc.Settings\CurVer",,,"igfxsrvc.Settings.1"
HKCR,"igfxsrvc.Settings.1\CLSID",,,"{078AEF33-C48A-49F7-AFF3-A0EE810BFE7C}"
HKCR,"CLSID\{078AEF33-C48A-49F7-AFF3-A0EE810BFE7C}",,,"Settings Class"
HKCR,"CLSID\{078AEF33-C48A-49F7-AFF3-
A0EE810BFE7C}\LocalServer32",,,%11%"\igfxsrvc.exe"
HKCR,"CLSID\{078AEF33-C48A-49F7-AFF3-A0EE810BFE7C}\ProgID",,,"igfxsrvc.Settings.1"
HKCR,"CLSID\{078AEF33-C48A-49F7-AFF3-
A0EE810BFE7C}\VersionIndependentProgID",,,"igfxsrvc.Settings"
HKCR,"Interface\{916FEC45-8FAB-460F-9BD1-325055E3DEC9}",,,"ISettings"

HKCR,"igfxsrvc.DisplayConfig\CLSID",,,"{C2BFE331-6739-4270-86C9-493D9A04CD38}"
HKCR,"igfxsrvc.DisplayConfig\CurVer",,,"igfxsrvc.DisplayConfig.1"
HKCR,"igfxsrvc.DispayConfig.1\CLSID",,,"{C2BFE331-6739-4270-86C9-493D9A04CD38}"
HKCR,"CLSID\{C2BFE331-6739-4270-86C9-493D9A04CD38}",,,"DisplayConfig Class"
HKCR,"CLSID\{C2BFE331-6739-4270-86C9-
493D9A04CD38}\LocalServer32",,,%11%"\igfxsrvc.exe"
HKCR,"CLSID\{C2BFE331-6739-4270-86C9-
493D9A04CD38}\ProgID",,,"igfxsrvc.DisplayConfig.1"
HKCR,"CLSID\{C2BFE331-6739-4270-86C9-
493D9A04CD38}\VersionIndependentProgID",,,"igfxsrvc.DisplayConfig"
HKCR,"Interface\{DC61FD6D-FB60-4ABC-BF2E-4DF75C90C601}",,,"IDisplayConfig"

HKCR,"igfxsrvc.EDID\CLSID",,,"{40CB6EA0-AB2A-45F8-BA45-2DC7756A7B49}"
HKCR,"igfxsrvc.EDID\CurVer",,,"igfxsrvc.EDID.1"
HKCR,"igfx.EDID.1\CLSID",,,"{40CB6EA0-AB2A-45F8-BA45-2DC7756A7B49}"
HKCR,"CLSID\{40CB6EA0-AB2A-45F8-BA45-2DC7756A7B49}",,,"EDID Class"
HKCR,"CLSID\{40CB6EA0-AB2A-45F8-BA45-
2DC7756A7B49}\LocalServer32",,,%11%"\igfxsrvc.exe"
HKCR,"CLSID\{40CB6EA0-AB2A-45F8-BA45-2DC7756A7B49}\ProgID",,,"igfxsrvc.EDID.1"
HKCR,"CLSID\{40CB6EA0-AB2A-45F8-BA45-
2DC7756A7B49}\VersionIndependentProgID",,,"igfxsrvc.EDID"
HKCR,"Interface\{B7C4F4C9-EE21-4042-9C11-BEA5E039B1F9}",,,"IEDID"

HKCR,"igfxsrvc.Color\CLSID",,,"{FE9617F6-E606-42AA-BECC-0E9CDA246D63}"
HKCR,"igfxsrvc.Color\CurVer",,,"igfxsrvc.Color.1"
HKCR,"igfx.Color.1\CLSID",,,"{FE9617F6-E606-42AA-BECC-0E9CDA246D63}"
HKCR,"CLSID\{FE9617F6-E606-42AA-BECC-0E9CDA246D63}",,,"Color Class"
HKCR,"CLSID\{FE9617F6-E606-42AA-BECC-
0E9CDA246D63}\LocalServer32",,,%11%"\igfxsrvc.exe"
HKCR,"CLSID\{FE9617F6-E606-42AA-BECC-0E9CDA246D63}\ProgID",,,"igfxsrvc.Color.1"
HKCR,"CLSID\{FE9617F6-E606-42AA-BECC-
0E9CDA246D63}\VersionIndependentProgID",,,"igfxsrvc.Color"
HKCR,"Interface\{63CDDDB9-A85B-411E-AA78-101B3BC17261}",,,"IColor"

HKCR,"igfxsrvc.CUIService",,,"CUIService Class"
HKCR,"igfxsrvc.CUIService\CLSID",,,"{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}"
HKCR,"igfxsrvc.CUIService\CurVer",,,"igfxsrvc.CUIService.1"
HKCR,"igfxsrvc.CUIService.1",,,"CUIService Class"
HKCR,"igfx.CUIService.1\CLSID",,,"{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}",,,"CUIService Class"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-
00A0C93CB1F4}\InProcServer32",,,%11%"\igfxsrvc.exe"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-
00A0C93CB1F4}\InProcServer32","ThreadingModel",,"Apartment"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-
00A0C93CB1F4}\ProgID",,,"igfxsrvc.CUIService.1"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-
00A0C93CB1F4}\VersionIndependentProgID",,,"igfxsrvc.CUIService"
```

```
HKCR,"igfxsrvc.CUIPower\CLSID",,,"{C332C124-340D-4430-AA0D-C75602876FCC}"
HKCR,"igfxsrvc.CUIPower\CurVer",,,"igfxsrvc.CUIPower.1"
HKCR,"igfx.CUIPower.1\CLSID",,,"{C332C124-340D-4430-AA0D-C75602876FCC}"
HKCR,"CLSID\{C332C124-340D-4430-AA0D-C75602876FCC}",,,"CUIPower Class"
HKCR,"CLSID\{C332C124-340D-4430-AA0D-
C75602876FCC}\LocalServer32",,,%11%"\igfxsrvc.exe"
HKCR,"CLSID\{C332C124-340D-4430-AA0D-C75602876FCC}\ProgID",,,"igfxsrvc.CUIPower.1"
HKCR,"CLSID\{C332C124-340D-4430-AA0D-
C75602876FCC}\VersionIndependentProgID",,,"igfxsrvc.CUIPower"
HKCR,"Interface\{299D88F9-2CBD-4225-BF19-FCD164C54C3F}",,,"ICUIPower"

HKCR,"igfxsrvc.MCCS\CLSID",,,"{999276E0-DA71-4743-8F02-0AB0A2D65558}"
HKCR,"igfxsrvc.MCCS\CurVer",,,"igfxsrvc.MCCS.1"
HKCR,"igfx.MCCS.1\CLSID",,,"{999276E0-DA71-4743-8F02-0AB0A2D65558}"
HKCR,"CLSID\{999276E0-DA71-4743-8F02-0AB0A2D65558}",,,"MCCS Class"
HKCR,"CLSID\{999276E0-DA71-4743-8F02-
0AB0A2D65558}\LocalServer32",,,%11%"\igfxsrvc.exe"
HKCR,"CLSID\{999276E0-DA71-4743-8F02-0AB0A2D65558}\ProgID",,,"igfxsrvc.MCCS.1"
HKCR,"CLSID\{999276E0-DA71-4743-8F02-
0AB0A2D65558}\VersionIndependentProgID",,,"igfxsrvc.MCCS"
HKCR,"Interface\{D80D344A-0CCD-4B2F-B379-56DE3EC2C4D1}",,,"IMCCS"

HKCR,"igfxsrvc.OpenGL\CLSID",,,"{DCB2D492-5F4F-4378-8FF4-DA87062D42E3}"
HKCR,"igfxsrvc.OpenGL\CurVer",,,"igfxsrvc.OpenGL.1"
HKCR,"igfx.OpenGL.1\CLSID",,,"{DCB2D492-5F4F-4378-8FF4-DA87062D42E3}"
HKCR,"CLSID\{DCB2D492-5F4F-4378-8FF4-DA87062D42E3}",,,"OpenGL Class"
HKCR,"CLSID\{DCB2D492-5F4F-4378-8FF4-
DA87062D42E3}\LocalServer32",,,%11%"\igfxsrvc.exe"
HKCR,"CLSID\{DCB2D492-5F4F-4378-8FF4-DA87062D42E3}\ProgID",,,"igfxsrvc.OpenGL.1"
HKCR,"CLSID\{DCB2D492-5F4F-4378-8FF4-
DA87062D42E3}\VersionIndependentProgID",,,"igfxsrvc.OpenGL"
HKCR,"Interface\{965FD393-C149-45F1-863C-402C4E2E38C5}",,,"IOpenGL"

HKCR,"igfxsrvc.Rotation\CLSID",,,"{9B908879-E03F-4D0C-ACB3-9065B1155460}"
HKCR,"igfxsrvc.Rotation\CurVer",,,"igfxsrvc.Rotation.1"
HKCR,"igfx.Rotation.1\CLSID",,,"{9B908879-E03F-4D0C-ACB3-9065B1155460}"
HKCR,"CLSID\{9B908879-E03F-4D0C-ACB3-9065B1155460}",,,"Rotation Class"
HKCR,"CLSID\{9B908879-E03F-4D0C-ACB3-
9065B1155460}\LocalServer32",,,%11%"\igfxsrvc.exe"
HKCR,"CLSID\{9B908879-E03F-4D0C-ACB3-9065B1155460}\ProgID",,,"igfxsrvc.Rotation.1"
HKCR,"CLSID\{9B908879-E03F-4D0C-ACB3-
9065B1155460}\VersionIndependentProgID",,,"igfxsrvc.Rotation"
HKCR,"Interface\{72DC5954-069D-43C4-9B8B-19B59269DC74}",,,"IRotation"

HKCR,"igfxsrvc.Scheme\CLSID",,,"{C071C982-2EB2-4D3A-9821-E4B31B0142C8}"
HKCR,"igfxsrvc.Scheme\CurVer",,,"igfxsrvc.Scheme.1"
HKCR,"igfx.Scheme.1\CLSID",,,"{C071C982-2EB2-4D3A-9821-E4B31B0142C8}"
HKCR,"CLSID\{C071C982-2EB2-4D3A-9821-E4B31B0142C8}",,,"Scheme Class"
HKCR,"CLSID\{C071C982-2EB2-4D3A-9821-
E4B31B0142C8}\LocalServer32",,,%11%"\igfxsrvc.exe"
HKCR,"CLSID\{C071C982-2EB2-4D3A-9821-E4B31B0142C8}\ProgID",,,"igfxsrvc.Scheme.1"
HKCR,"CLSID\{C071C982-2EB2-4D3A-9821-
E4B31B0142C8}\VersionIndependentProgID",,,"igfxsrvc.Scheme"
HKCR,"Interface\{D5393CA5-EF8F-49E0-B180-212C903C652C}",,,"IScheme"

HKCR,"igfxsrvc.TVParam\CLSID",,,"{12E3793C-7C3C-4C00-BC4E-C79849B3F430}"
HKCR,"igfxsrvc.TVParam\CurVer",,,"igfxsrvc.TVParam.1"
HKCR,"igfx.TVParam.1\CLSID",,,"{12E3793C-7C3C-4C00-BC4E-C79849B3F430}"
HKCR,"CLSID\{12E3793C-7C3C-4C00-BC4E-C79849B3F430}",,,"TVParam Class"
HKCR,"CLSID\{12E3793C-7C3C-4C00-BC4E-
C79849B3F430}\LocalServer32",,,%11%"\igfxsrvc.exe"
HKCR,"CLSID\{12E3793C-7C3C-4C00-BC4E-C79849B3F430}\ProgID",,,"igfxsrvc.TVParam.1"
HKCR,"CLSID\{12E3793C-7C3C-4C00-BC4E-
C79849B3F430}\VersionIndependentProgID",,,"igfxsrvc.TVParam"
HKCR,"Interface\{DDA11344-AB20-4AEC-94C4-6AA091574CD0}",,,"ITVParam"
;
;proxy stub for igfxsrvc.exe
```

```
;
HKCR,"CLSID\{DDA11344-AB20-4AEC-94C4-6AA091574CD0}",,,"PSFactoryBuffer"
HKCR,"CLSID\{DDA11344-AB20-4AEC-94C4-
6AA091574CD0}\InProcServer32",,,%11%"\igfxsrvc.dll"
HKCR,"CLSID\{DDA11344-AB20-4AEC-94C4-
6AA091574CD0}\InProcServer32","ThreadingModel",,"Both";

HKCR,"Interface\{DDA11344-AB20-4AEC-94C4-6AA091574CD0}",,,"ITVParam"
HKCR,"Interface\{DDA11344-AB20-4AEC-94C4-
6AA091574CD0}\ProxyStubClsid32",,,"{DDA11344-AB20-4AEC-94C4-6AA091574CD0}"
HKCR,"Interface\{DDA11344-AB20-4AEC-94C4-6AA091574CD0}\NumMethods",,,"9"

HKCR,"Interface\{916FEC45-8FAB-460F-9BD1-325055E3DEC9}",,,"ISettings"
HKCR,"Interface\{916FEC45-8FAB-460F-9BD1-
325055E3DEC9}\ProxyStubClsid32",,,"{DDA11344-AB20-4AEC-94C4-6AA091574CD0}"
HKCR,"Interface\{916FEC45-8FAB-460F-9BD1-325055E3DEC9}\NumMethods",,,"13"

HKCR,"Interface\{D5393CA5-EF8F-49E0-B180-212C903C652C}",,,"IScheme"
HKCR,"Interface\{D5393CA5-EF8F-49E0-B180-
212C903C652C}\ProxyStubClsid32",,,"{DDA11344-AB20-4AEC-94C4-6AA091574CD0}"
HKCR,"Interface\{D5393CA5-EF8F-49E0-B180-212C903C652C}\NumMethods",,,"7"

HKCR,"Interface\{72DC5954-069D-43C4-9B8B-19B59269DC74}",,,"IRotation"
HKCR,"Interface\{72DC5954-069D-43C4-9B8B-
19B59269DC74}\ProxyStubClsid32",,,"{DDA11344-AB20-4AEC-94C4-6AA091574CD0}"
HKCR,"Interface\{72DC5954-069D-43C4-9B8B-19B59269DC74}\NumMethods",,,"9"

HKCR,"Interface\{25824158-68E7-4A6F-A2FD-
F6AD1D6845D4}\ProxyStubClsid32",,,"{DDA11344-AB20-4AEC-94C4-6AA091574CD0}"
HKCR,"Interface\{25824158-68E7-4A6F-A2FD-F6AD1D6845D4}\NumMethods",,,"13"

HKCR,"Interface\{965FD393-C149-45F1-863C-402C4E2E38C5}",,,"IOpenGL"
HKCR,"Interface\{965FD393-C149-45F1-863C-
402C4E2E38C5}\ProxyStubClsid32",,,"{DDA11344-AB20-4AEC-94C4-6AA091574CD0}"
HKCR,"Interface\{965FD393-C149-45F1-863C-402C4E2E38C5}\NumMethods",,,"7"

HKCR,"Interface\{D80D344A-0CCD-4B2F-B379-56DE3EC2C4D1}",,,"IMCCS"
HKCR,"Interface\{D80D344A-0CCD-4B2F-B379-
56DE3EC2C4D1}\ProxyStubClsid32",,,"{DDA11344-AB20-4AEC-94C4-6AA091574CD0}"
HKCR,"Interface\{D80D344A-0CCD-4B2F-B379-56DE3EC2C4D1}\NumMethods",,,"9"

HKCR,"Interface\{B7C4F4C9-EE21-4042-9C11-BEA5E039B1F9}",,,"IEDID"
HKCR,"Interface\{B7C4F4C9-EE21-4042-9C11-
BEA5E039B1F9}\ProxyStubClsid32",,,"{DDA11344-AB20-4AEC-94C4-6AA091574CD0}"
HKCR,"Interface\{B7C4F4C9-EE21-4042-9C11-BEA5E039B1F9}\NumMethods",,,"12"

HKCR,"Interface\{DC61FD6D-FB60-4ABC-BF2E-4DF75C90C601}",,,"IDisplayConfig"
HKCR,"Interface\{DC61FD6D-FB60-4ABC-BF2E-
4DF75C90C601}\ProxyStubClsid32",,,"{DDA11344-AB20-4AEC-94C4-6AA091574CD0}"
HKCR,"Interface\{DC61FD6D-FB60-4ABC-BF2E-4DF75C90C601}\NumMethods",,,"15"

HKCR,"Interface\{299D88F9-2CBD-4225-BF19-FCD164C54C3F}",,,"ICUIPower"
HKCR,"Interface\{299D88F9-2CBD-4225-BF19-
FCD164C54C3F}\ProxyStubClsid32",,,"{DDA11344-AB20-4AEC-94C4-6AA091574CD0}"
HKCR,"Interface\{299D88F9-2CBD-4225-BF19-FCD164C54C3F}\NumMethods",,,"7"

HKCR,"Interface\{63CDDDB9-A85B-411E-AA78-101B3BC17261}",,,"IColor"
HKCR,"Interface\{63CDDDB9-A85B-411E-AA78-
101B3BC17261}\ProxyStubClsid32",,,"{DDA11344-AB20-4AEC-94C4-6AA091574CD0}"
HKCR,"Interface\{63CDDDB9-A85B-411E-AA78-101B3BC17261}\NumMethods",,,"14"
;
; igfxpph.dll self registration entries
;
HKCR,"igfxpph.GraphicsShellExt",,,"GraphicsShellExt Class"
HKCR,"igfxpph.GraphicsShellExt\CLSID",,,"{3AB1675A-CCFF-11D2-8B20-00A0C93CB1F4}"
HKCR,"igfxpph.GraphicsShellExt\CurVer",,,"igfxpph.GraphicsShellExt.1"
HKCR,"igfxpph.GraphicsShellExt.1",,,"GraphicsShellExt Class"
```



```
HKCR,"igfxpph.GraphicsShellExt.1\CLSID",,,"{3AB1675A-CCFF-11D2-8B20-00A0C93CB1F4}"
HKCR,"CLSID\{3AB1675A-CCFF-11D2-8B20-00A0C93CB1F4}",,,"GraphicsShellExt Class"
HKCR,"CLSID\{3AB1675A-CCFF-11D2-8B20-
00A0C93CB1F4}\InProcServer32",,,%11%"\igfxpph.dll"
HKCR,"CLSID\{3AB1675A-CCFF-11D2-8B20-
00A0C93CB1F4}\InProcServer32","ThreadingModel",,"Apartment"
HKCR,"CLSID\{3AB1675A-CCFF-11D2-8B20-
00A0C93CB1F4}\ProgID",,,"igfxpph.GraphicsShellExt.1"
HKCR,"CLSID\{3AB1675A-CCFF-11D2-8B20-
00A0C93CB1F4}\VersionIndependentProgID",,,"igfxpph.GraphicsShellExt"
HKCR,"CLSID\{3AB1675A-CCFF-11D2-8B20-00A0C93CB1F4}\Programmable",,,

;
; Igfxdo.dll self registration entries
;
HKCR,"Igfxdo.DataObject",,,"DataObject Class"
HKCR,"Igfxdo.DataObject\CLSID",,,"{D4FA3D4E-BE69-11D4-AA30-00902704C6BF}"
HKCR,"Igfxdo.DataObject\CurVer",,,"Igfxdo.DataObject.1"
HKCR,"Igfxdo.DataObject.1",,,"DataObject Class"
HKCR,"Igfxdo.DataObject.1\CLSID",,,"{D4FA3D4E-BE69-11D4-AA30-00902704C6BF}"
HKCR,"CLSID\{D4FA3D4E-BE69-11D4-AA30-00902704C6BF}",,,"DataObject Class"
HKCR,"CLSID\{D4FA3D4E-BE69-11D4-AA30-
00902704C6BF}\InProcServer32",,,%11%"\igfxdo.dll"
HKCR,"CLSID\{D4FA3D4E-BE69-11D4-AA30-
00902704C6BF}\InProcServer32","ThreadingModel",,"Apartment"
HKCR,"CLSID\{D4FA3D4E-BE69-11D4-AA30-00902704C6BF}\ProgID",,,"Igfxdo.DataObject.1"
HKCR,"CLSID\{D4FA3D4E-BE69-11D4-AA30-
00902704C6BF}\VersionIndependentProgID",,,"Igfxdo.DataObject"
HKCR,"CLSID\{D4FA3D4E-BE69-11D4-AA30-00902704C6BF}\Programmable",,,

HKCR,"Igfxdo.DataObjectInit",,,"DataObjectInit Class"
HKCR,"Igfxdo.DataObjectInit\CLSID",,,"{4501A903-BF07-11D4-AA30-00902704C6BF}"
HKCR,"Igfxdo.DataObjectInit\CurVer",,,"Igfxdo.DataObjectInit.1"
HKCR,"Igfxdo.DataObjectInit.1",,,"DataObjectInit Class"
HKCR,"Igfxdo.DataObjectInit.1\CLSID",,,"{4501A903-BF07-11D4-AA30-00902704C6BF}"
HKCR,"CLSID\{4501A903-BF07-11D4-AA30-00902704C6BF}",,,"DataObjectInit Class"
HKCR,"CLSID\{4501A903-BF07-11D4-AA30-
00902704C6BF}\InProcServer32",,,%11%"\igfxdo.dll"
HKCR,"CLSID\{4501A903-BF07-11D4-AA30-
00902704C6BF}\InProcServer32","ThreadingModel",,"Apartment"
HKCR,"CLSID\{4501A903-BF07-11D4-AA30-
00902704C6BF}\ProgID",,,"Igfxdo.DataObjectInit.1"
HKCR,"CLSID\{4501A903-BF07-11D4-AA30-
00902704C6BF}\VersionIndependentProgID",,,"Igfxdo.DataObjectInit"
HKCR,"CLSID\{4501A903-BF07-11D4-AA30-00902704C6BF}\Programmable",,,

;
; IgfxExtps.dll self registration entries
;
; IgfxExtps.dll portion
HKCR,"CLSID\{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}",,,"PSFactoryBuffer"
HKCR,"CLSID\{5DC5B31E-0C28-4679-B8D8-
32CF2F9BACED}\InProcServer32",,,%11%"\IgfxExtps.dll"
HKCR,"CLSID\{5DC5B31E-0C28-4679-B8D8-
32CF2F9BACED}\InProcServer32","ThreadingModel",,"Both"
HKLM,"SOFTWARE\Classes\CLSID\{5DC5B31E-0C28-4679-B8D8-
32CF2F9BACED}",,,"PSFactoryBuffer"
HKLM,"SOFTWARE\Classes\CLSID\{5DC5B31E-0C28-4679-B8D8-
32CF2F9BACED}\InProcServer32",,,%11%"\IgfxExtps.dll"
HKLM,"SOFTWARE\Classes\CLSID\{5DC5B31E-0C28-4679-B8D8-
32CF2F9BACED}\InProcServer32","ThreadingModel",,"Both"
```

```
HKLM,"SOFTWARE\Classes\Interface\{27E7234F-429F-4787-AC8F-
8AADDED01355}",,,"ICUIExternal2"
HKLM,"SOFTWARE\Classes\Interface\{27E7234F-429F-4787-AC8F-
8AADDED01355}\NumMethods",,,"11"
HKLM,"SOFTWARE\Classes\Interface\{27E7234F-429F-4787-AC8F-
8AADDED01355}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"

HKLM,"SOFTWARE\Classes\Interface\{2CED2F89-627B-4E5D-840F-
B126EE858CD8}",,,"ICUIExternal7"
HKLM,"SOFTWARE\Classes\Interface\{2CED2F89-627B-4E5D-840F-
B126EE858CD8}\NumMethods",,,"36"
HKLM,"SOFTWARE\Classes\Interface\{2CED2F89-627B-4E5D-840F-
B126EE858CD8}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"

HKLM,"SOFTWARE\Classes\Interface\{3473E05A-3317-4DF5-9098-
E5387C94D1B0}",,,"ICUIExternalDual"
HKLM,"SOFTWARE\Classes\Interface\{3473E05A-3317-4DF5-9098-
E5387C94D1B0}\NumMethods",,,"7"
HKLM,"SOFTWARE\Classes\Interface\{3473E05A-3317-4DF5-9098-
E5387C94D1B0}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"

HKLM,"SOFTWARE\Classes\Interface\{5DC5B31E-0C28-4679-B8D8-
32CF2F9BACED}",,,"ICUIExternal4"
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32CF2F9BACED}\NumMethods",,,"20"
HKLM,"SOFTWARE\Classes\Interface\{5DC5B31E-0C28-4679-B8D8-
32CF2F9BACED}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"

HKLM,"SOFTWARE\Classes\Interface\{70F8C65F-06AA-443B-9E6B-
7C73808F07E5}",,,"ICUIExternal3"
HKLM,"SOFTWARE\Classes\Interface\{70F8C65F-06AA-443B-9E6B-
7C73808F07E5}\NumMethods",,,"13"
HKLM,"SOFTWARE\Classes\Interface\{70F8C65F-06AA-443B-9E6B-
7C73808F07E5}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"

HKLM,"SOFTWARE\Classes\Interface\{A05C525D-B4CB-4108-BFF7-
1ACF1A14F00A}",,,"ICUIExternal5"
HKLM,"SOFTWARE\Classes\Interface\{A05C525D-B4CB-4108-BFF7-
1ACF1A14F00A}\NumMethods",,,"23"
HKLM,"SOFTWARE\Classes\Interface\{A05C525D-B4CB-4108-BFF7-
1ACF1A14F00A}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"

HKLM,"SOFTWARE\Classes\Interface\{AFB6489F-4515-44AA-8DF7-
ED28EA46283C}",,,"ICUIExternal6"
HKLM,"SOFTWARE\Classes\Interface\{AFB6489F-4515-44AA-8DF7-
ED28EA46283C}\NumMethods",,,"36"
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ED28EA46283C}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"

HKLM,"SOFTWARE\Classes\Interface\{F932C038-6484-45CA-8FA1-
7C8C279F7AEE}",,,"ICUIExternal8"
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7C8C279F7AEE}\NumMethods",,,"38"
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7C8C279F7AEE}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"


;
; igfxtray.exe execution on startup
;
HKLM,Software\Microsoft\Windows\CurrentVersion\Run,IgfxTray,,%11%"\igfxtray.exe"
HKLM,Software\Microsoft\Windows\CurrentVersion\Run,HotKeysCmds,,%11%"\hkcmd.exe"
HKLM,Software\Microsoft\Windows\CurrentVersion\Run,IgfxExt,,%11%"\IgfxExt.exe /
RegServer"
;
;
```
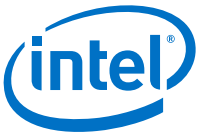



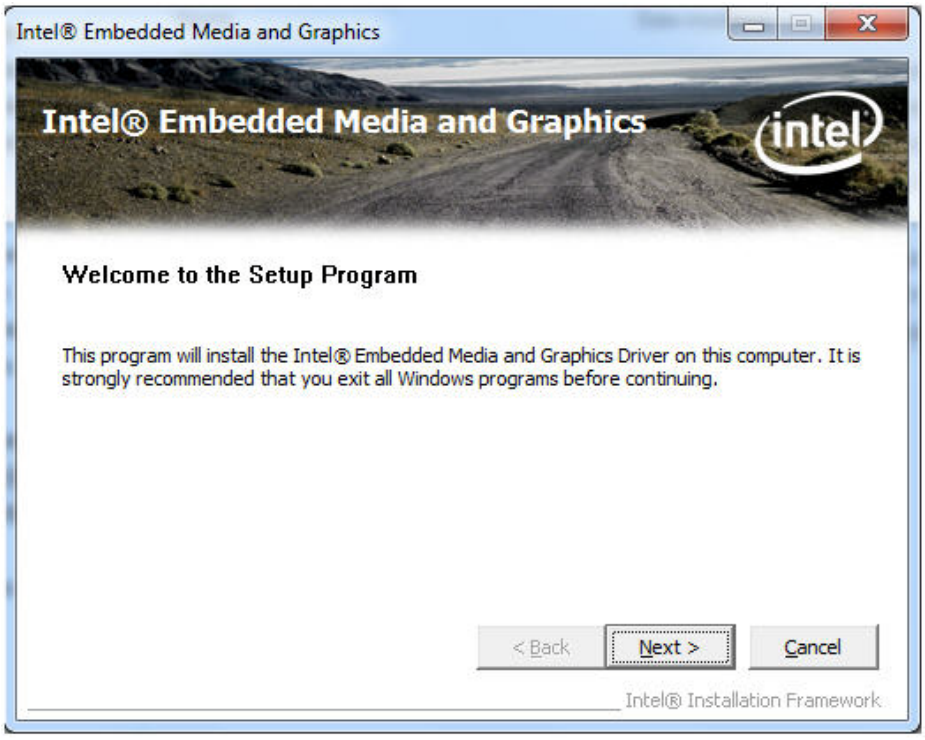
```
; Entries for receiving winlogon unlock event
;

HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","4519",,""
;zoom
HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","4515",,""
;opengl 3d
HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","4518",,""
; ??
HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","4517",,""
;Dual Frequency Power Settings
HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","4660",,""



;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
[Strings]
;
; Non-Localizable Strings
;
REG_SZ          = 0x00000000
REG_MULTI_SZ    = 0x00010000
REG_DWORD       = 0x00010001
SERVICEROOT     = "System\CurrentControlSet\Services"

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;
; Localizable Strings
;
DiskId          = "Intel(R) Embedded Media and Graphics Driver"
Intel           = "Intel(R)"
i900G0="US15 Embedded Media and Graphics Controller"
iTNC0="Atom (TM) E6xx Embedded Media and Graphics Controller"

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;
; CUI Strings
;
CUIDeviceIndependentKey="Software\Intel\Display\igfxcui"
DisplayKey="Software\Intel\Display"

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
[CUISDK_Registration]
11,,IgfxExt.exe,1

;
; Do not modify or copy the following line
; set SIGNING_KEY_VERSION=1
;
```

5.3 Installing Intel® Embedded Media and Graphics Driver on Microsoft Windows* 7 and Windows* Embedded Standard 7

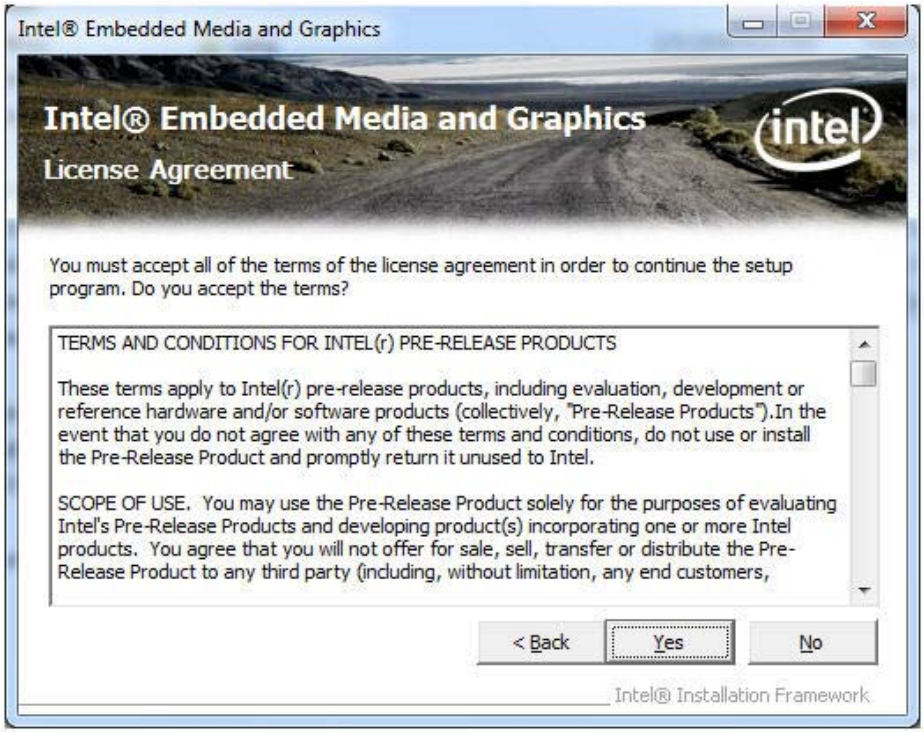
You can install the Intel® Embedded Media and Graphics Driver on a Microsoft Windows system by using the `setup.exe` program located in the `IEMGD_HEAD_Windows7` folder. The following procedure shows how to install the Intel® Embedded Media and Graphics Driver. Section 5.4, “Uninstalling the Current Version of the Driver” on page 85 provides instructions for uninstalling the current version of the Intel® Embedded Media and Graphics Driver.

5.3.1 Automated Installation Using Setup.exe

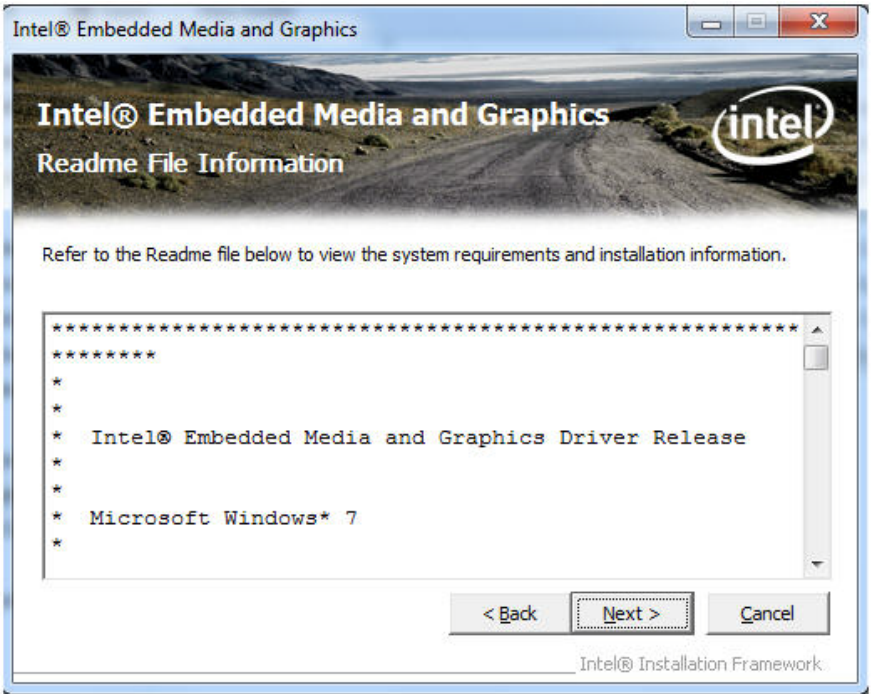
1. Locate the hard drive directory where the driver files are stored. By default CED places the driver installer files in directory `\workplace\installation\<package name_installation>\IEMGD_HEAD_Windows7`
2. Copy this directory to the target computer on which Intel® EMGD is to be installed.
3. Run `Setup.exe`. The confirmation dialog appears; select **Yes** to continue. The install dialog appears. Click **Next** to continue.


Intel® Embedded Media and Graphics
Intel® Embedded Media and Graphics
Welcome to the Setup Program
This program will install the Intel® Embedded Media and Graphics Driver on this computer. It is strongly recommended that you exit all Windows programs before continuing.
< Back
Next >
Cancel
Intel® Installation Framework

4. Read the License Agreement and click **Yes** to proceed.


Intel® Embedded Media and Graphics
Intel® Embedded Media and Graphics
License Agreement
You must accept all of the terms of the license agreement in order to continue the setup program. Do you accept the terms?
TERMS AND CONDITIONS FOR INTEL(r) PRE-RELEASE PRODUCTS
These terms apply to Intel(r) pre-release products, including evaluation, development or reference hardware and/or software products (collectively, "Pre-Release Products").In the event that you do not agree with any of these terms and conditions, do not use or install the Pre-Release Product and promptly return it unused to Intel.
SCOPE OF USE. You may use the Pre-Release Product solely for the purposes of evaluating Intel's Pre-Release Products and developing product(s) incorporating one or more Intel products. You agree that you will not offer for sale, sell, transfer or distribute the Pre-Release Product to any third party (including, without limitation, any end customers,
< Back
Yes
No
Intel® Installation Framework

5. Review the Readme file information and then click **Next** to proceed.



6. The Windows Security warning dialog appears. Click I**nstall this driver software anyway**. The installation starts.

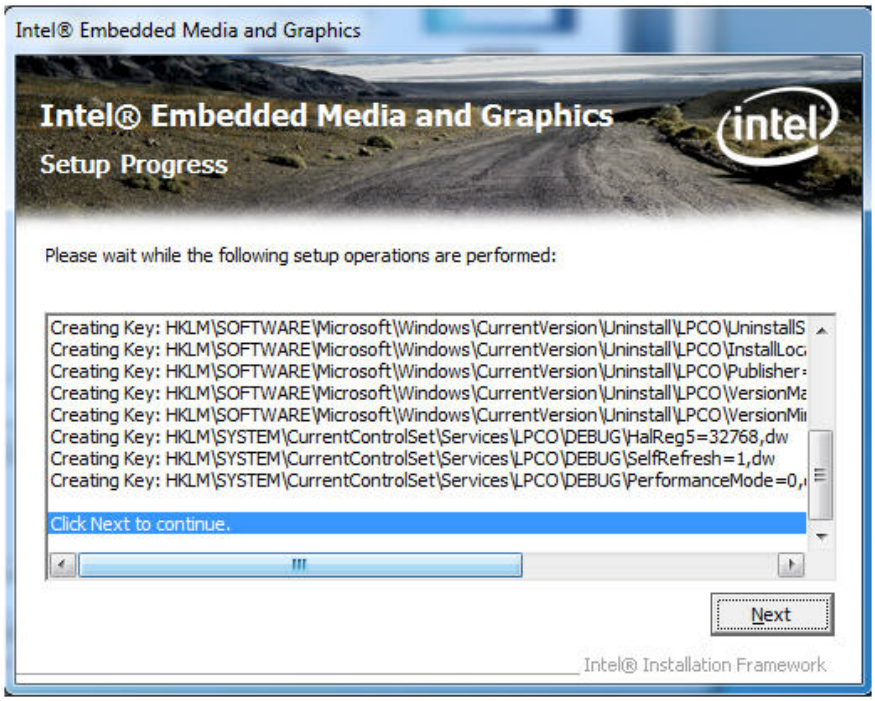
Windows Security
Windows can't verify the publisher of this driver software
Don't install this driver software
You should check your manufacturer's website for updated driver software for your device.
Install this driver software anyway
Only install driver software obtained from your manufacturer's website or disc. Unsigned software from other sources may harm your computer or steal information.
See details

Notes:

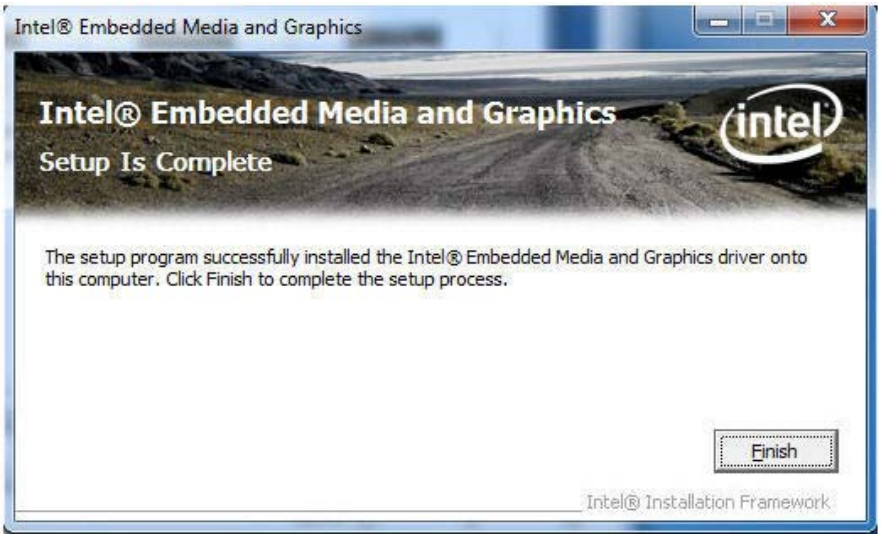
a) For the Intel® Atom Processor E6xx platform, the Windows Security warning dialog appears twice: the first warning when the Device 3 driver is installed and the second warning when the graphics driver is installed. For more details about Device 3 driver, refer to Section 5.3.3

b) For the Intel® US15W platform, the Windows Security warning dialog appears once when the graphics driver is installed.

7. When the Setup Progress is complete, click **Next** to proceed.



8. The Setup Complete screen appears. Click **Finish** and then restart your computer.


Intel® Embedded Media and Graphics
Intel® Embedded Media and Graphics
Setup Is Complete
The setup program successfully installed the Intel® Embedded Media and Graphics driver onto this computer. Click Finish to complete the setup process.
Finish
Intel® Installation Framework

5.3.2 Power Plan Settings for Windows* Embedded Standard 7 SP1

By default, the power plan option for Windows Embedded Standard 7 SP1 is set to Balanced with minimum processor state set to 5%. This is different from the power plan default settings in Windows 7, where the power plan is set to Balanced with minimum processor state set to 100%.

The default Balanced power plan in Windows Embedded Standard with minimum processor state set to 5% engages Intel® SpeedStep aggressively, throttling down the CPU clock, causing a throughput reduction and higher CPU utilization. This action impacts CPU utilization across the board in video playbacks, 3D performance, and even the CPU when it is in an idle state. To avoid this situation, there are two options to gain the same performance as in Windows 7:

- Change the Power Plan option in Windows Control Panel to High Performance (Intel® recommended)

  or

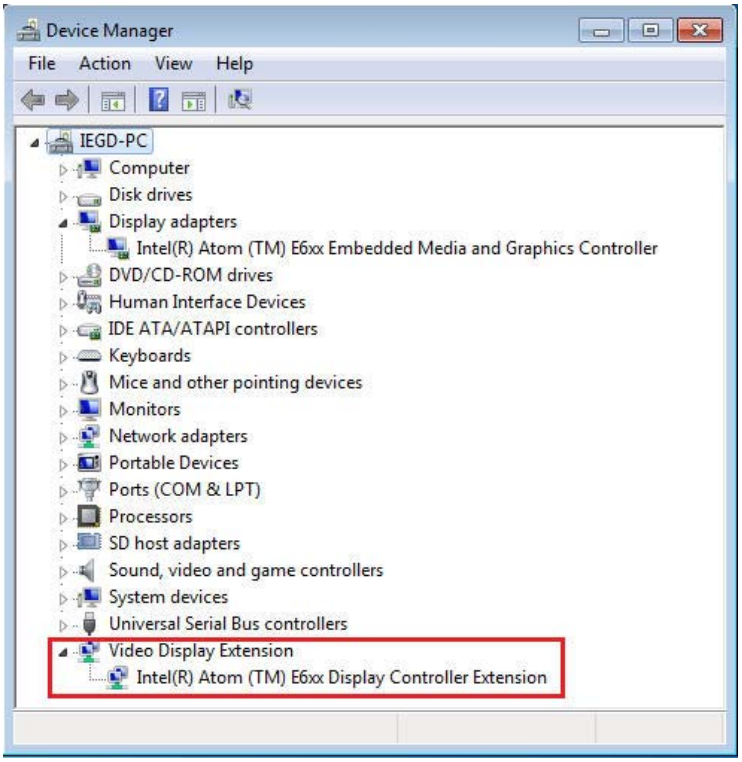
- Turn off the Intel® SpeedStep BIOS option

5.3.3 Device 3 Display in Windows Device Manager for Intel® Atom™ Processor E6xx Platform

Device 3 (PCI Device on Bus 0, Device 3, Function 0) is a display controller extension for the Intel® Atom™ Processor E6xx platform. Device 3 cannot display graphics by itself; it is programmed and controlled by the Device 2 (graphics driver) driver.

Device 3 can be viewed from the Windows Device Manager as shown in the figure below.

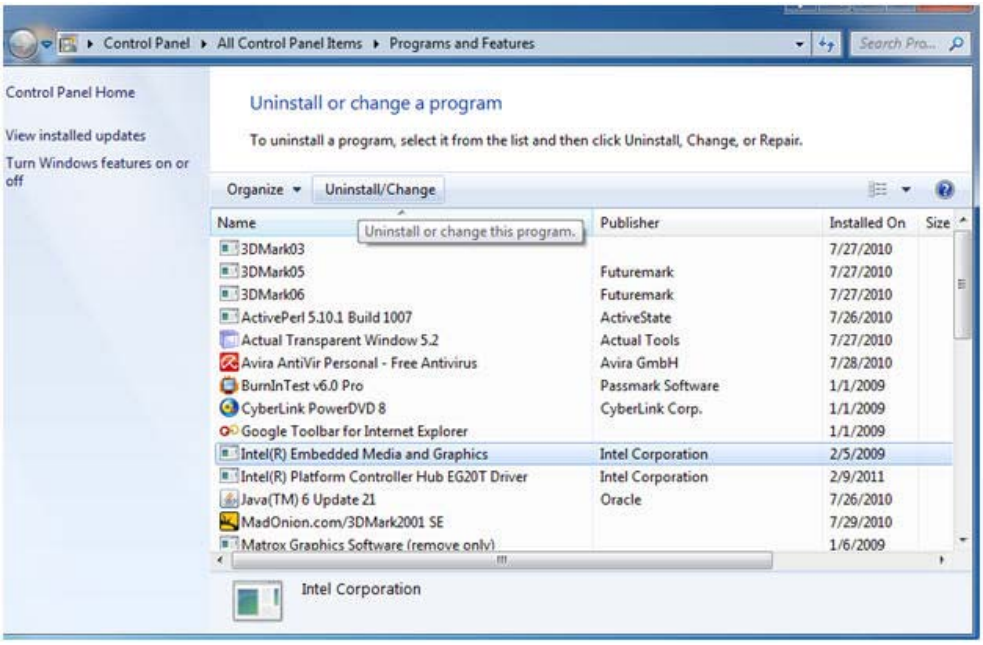
Figure 21. Device 3 for Intel® Atom™ Processor E6xx Platform



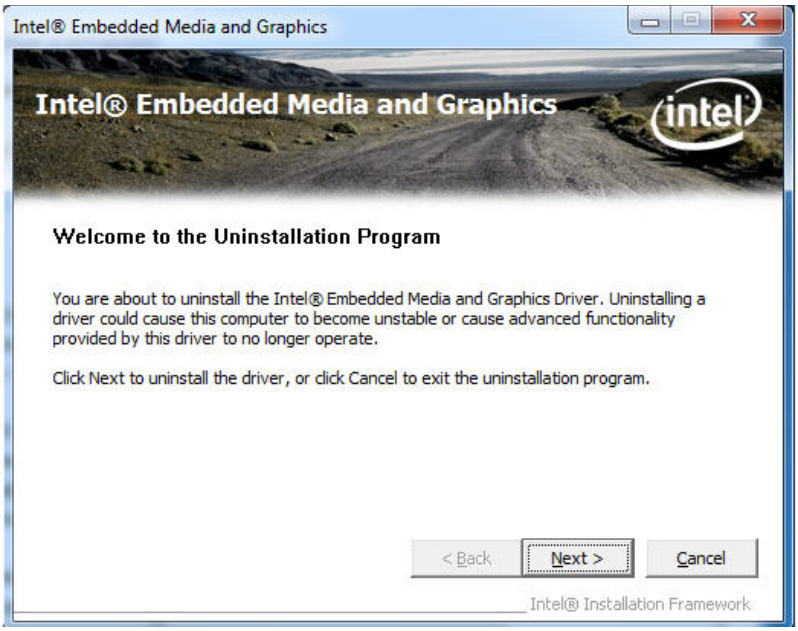
Note: There is no Device 3 for Intel® US15W.

5.4 Uninstalling the Current Version of the Driver

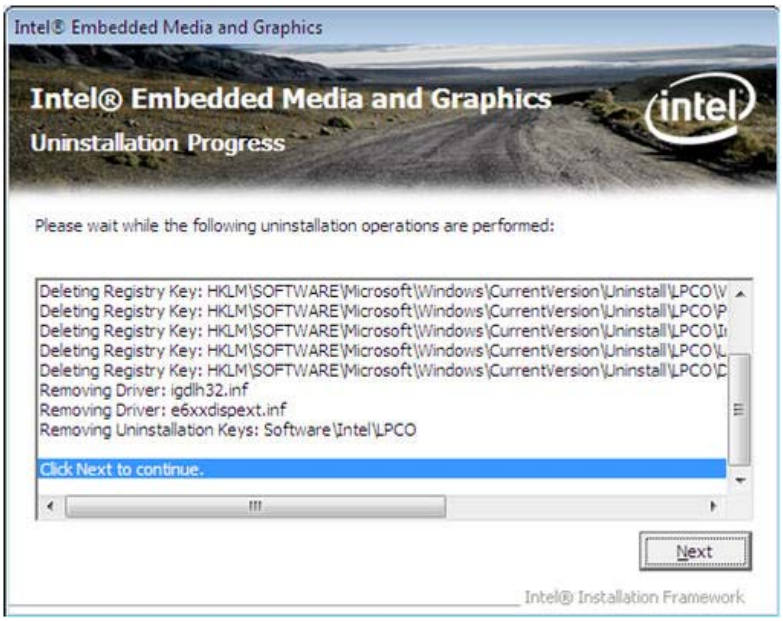
1. Click **Start**, open the Control Panel, and select **Programs and Features**.
2. Select Intel® Embedded Media and Graphics and click **Uninstall/Change**.


Control Panel ▸ All Control Panel Items ▸ Programs and Features
Search Pro...
Control Panel Home
View installed updates
Turn Windows features on or off
Uninstall or change a program
To uninstall a program, select it from the list and then click Uninstall, Change, or Repair.
Organize
Uninstall/Change
Uninstall or change this program.
Name
Publisher
Installed On
Size
3DMark03 7/27/2010
3DMark05 Futuremark 7/27/2010
3DMark06 Futuremark 7/27/2010
ActivePerl 5.10.1 Build 1007 ActiveState 7/26/2010
Actual Transparent Window 5.2 Actual Tools 7/27/2010
Avira AntiVir Personal - Free Antivirus Avira GmbH 7/28/2010
BurnInTest v6.0 Pro Passmark Software 1/1/2009
CyberLink PowerDVD 8 CyberLink Corp. 1/1/2009
Google Toolbar for Internet Explorer 1/1/2009
Intel(R) Embedded Media and Graphics Intel Corporation 2/5/2009
Intel(R) Platform Controller Hub EG20T Driver Intel Corporation 2/9/2011
Java(TM) 6 Update 21 Oracle 7/26/2010
MadOnion.com/3DMark2001 SE 7/29/2010
Matrox Graphics Software (remove only) 1/6/2009
Intel Corporation

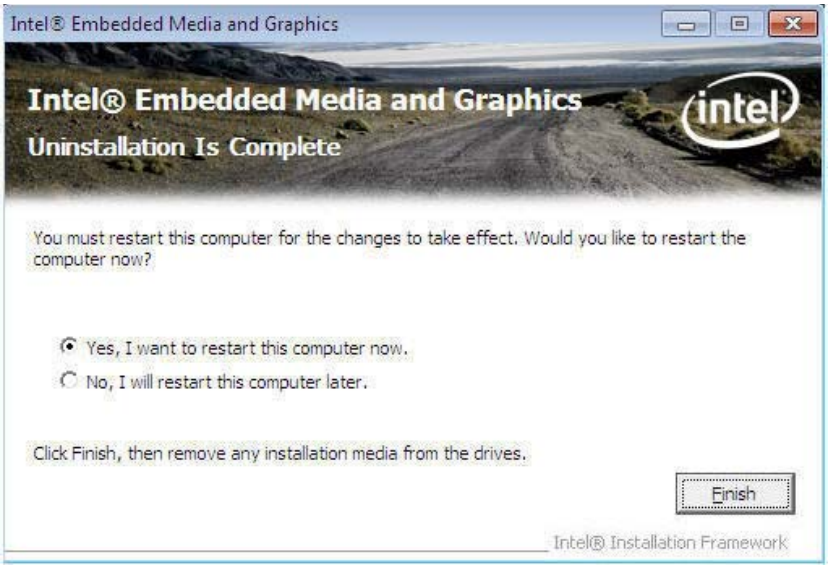
3. Click **Next** when prompted at the “Welcome to Uninstallation Program” dialog.


Intel® Embedded Media and Graphics
Intel® Embedded Media and Graphics
Welcome to the Uninstallation Program
You are about to uninstall the Intel® Embedded Media and Graphics Driver. Uninstalling a driver could cause this computer to become unstable or cause advanced functionality provided by this driver to no longer operate.
Click Next to uninstall the driver, or click Cancel to exit the uninstallation program.
< Back
Next >
Cancel
Intel® Installation Framework

4. When the Uninstallation Progress is complete click **Next** to proceed.



5. The “Uninstallation Complete” screen appears. Click **Finish** and then restart your computer.


Intel® Embedded Media and Graphics
Intel® Embedded Media and Graphics
Uninstallation Is Complete
You must restart this computer for the changes to take effect. Would you like to restart the computer now?
Yes, I want to restart this computer now.
No, I will restart this computer later.
Click Finish, then remove any installation media from the drives.
Finish
Intel® Installation Framework

6. To verify that the driver has been uninstalled, return to the “Uninstall or Change a Program” list and ensure that there is no Intel® Embedded Media and Graphics Driver listed.

5.5 Run-Time Operation

Resolution, refresh rate, and color bit depth can be changed after installation and reboot via a Microsoft Windows display property sheet. Other operations such as enabling and disabling ports (display output), rotation, port configuration, and attribute control are accessible via the standard display driver escape protocol.

5.6 Viewing and Changing the Driver Configuration from Microsoft Windows

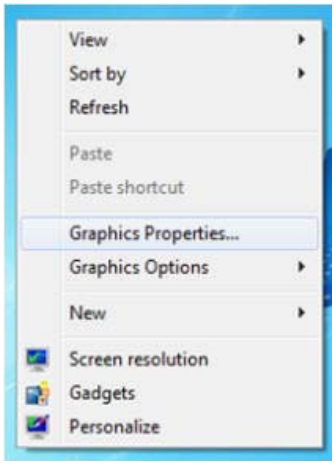
On Microsoft Windows* 7 systems, you can change configuration attributes of the Intel® Embedded Media and Graphics Driver using the Common User Interface (CUI). You can access the CUI from various methods such as the Desktop Context Menu, the Tray Icon Menu, the Windows* Control Panel, and through a hot key. The CUI property pages consist of the following sections:

- **Display Devices** – Contains current active devices information and allows configuration of a display device for single and multiple displays.
- **Display Settings** – Allows configuration of display screen resolution, refresh rate, color depth, rotation, and image proportion options for each device on single or multi-display configurations.
- **Color Correction** – Contains color-correction information for the framebuffer and provides the ability to adjust the displayed colors.
- **Hot Keys** – Contains all the supported hot keys and provides an option to enable/disable the all hot keys or a specific hot key.
- **Information** – Contains general information about the user's system and graphics driver information.

To view or change the driver settings using the CUI interface, follow this procedure.

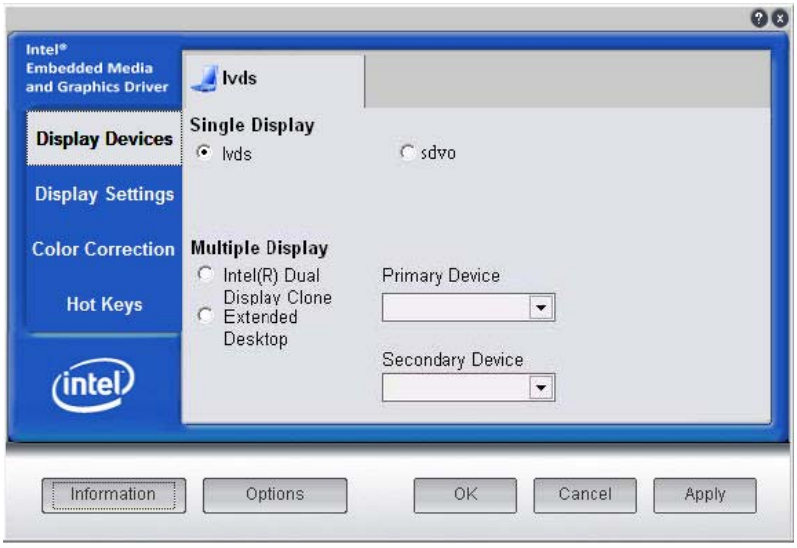
1. To invoke CUI, right-click on an empty spot anywhere on the desktop and select **Graphics Properties**.

Figure 22. Desktop Context Menu – Graphics Properties



The **Display Device** Page is the first page to appear when CUI is launched.

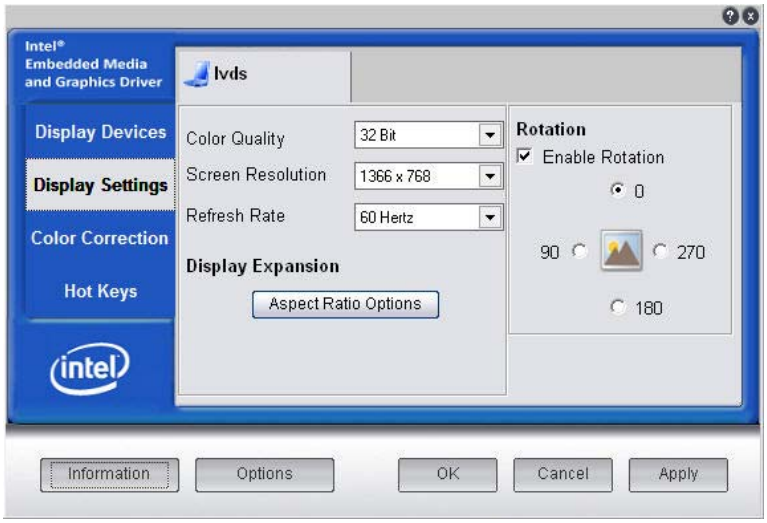
Figure 23. Example Runtime Configuration CUI – Display Devices Page



The **Display Devices** page shows the current active devices. The device name is derived from Readable Port Name that the user defined in CED.

2. Choose Single, Clone or Extended Displays. For Multiple Display, select the devices for Primary Device and Secondary Device. If you choose Extended desktop, you may position the extended desktop. Click **OK** or **Apply** to save the changes.
3. To view and change display screen resolution, click on the **Display Settings** Page. You can change refresh rate, color depth, rotation and image proportion for the selected device as described below.

Figure 24. Example Runtime Configuration CUI – Display Settings Page



— **Color Quality**: Allows user to select the required color quality

— **Screen Resolution**: Allows user to select the screen resolution

— **Refresh Rate**: Allows user to select the refresh rate

— **Rotation**: User can rotate the display 0, 90, 180, and 270 degrees

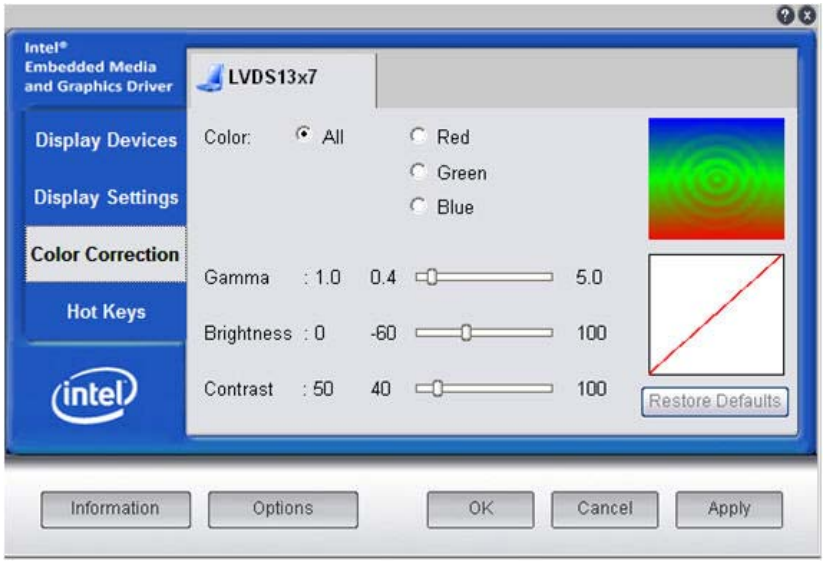
— **Aspect Ratio Options**: Allows user to choose between different aspect ratio settings

If there is a dual display, it will provide a separate page to adjust settings for each display device. Click **OK** or **Apply** for the changes made.

4. To view and change the color corrections, click on the **Color Correction** Page. Color Correction is available for framebuffers.

Note: The changes made are immediately active without selecting **OK** or **Apply**.

Figure 25. Example Runtime Configuration CUI – Color Correction Page



— **Gamma**: Enables the user to adjust the gamma of all the colors or adjust the gamma of red, green and blue individually. The **gamma ramp graph** will display the shape of gamma curve for each of the RGB colors separately. If the gamma adjustment is done for all of the colors instead of individually, the gamma ramp graph displays only one line.

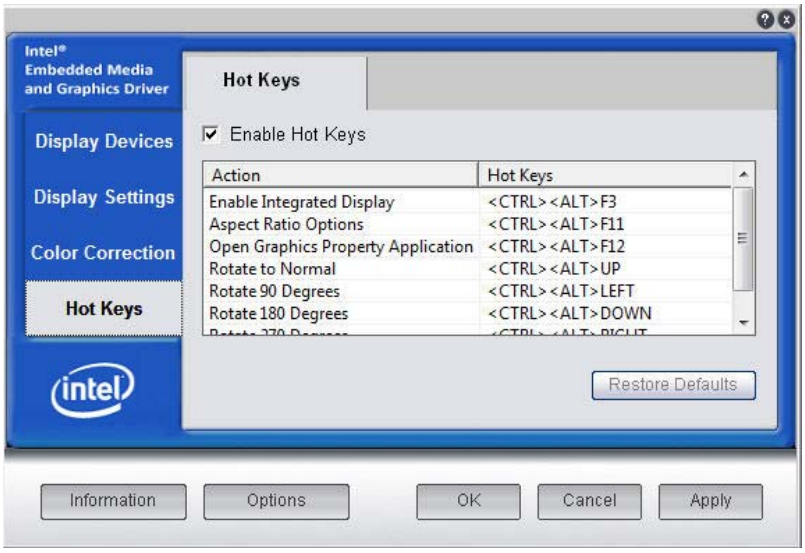
— **Brightness**: Enables the user to adjust the brightness of all the colors or adjust the brightness of red, green, and blue individually.

— **Contrast**: Enables the user to adjust the contrast of all the colors or adjust the contrast of red, green, and blue individually.

— **Restore Defaults**: Enables the user to return to the default settings.

5. To view and change the default key combination to invoke various CUI functions, click on the **Hot Keys** Page. These options allow the user to avoid potential conflicts with other application hot keys.

Figure 26. Example Runtime Configuration CUI – Hot Keys Page



CUI shows all the valid, supported hot key actions and hot keys. Users can enable or disable the all hot keys or a specific hot key.

— To disable a specific hot key, select it from the list and then click **Disable**.

— To change the hot key for a specific action, select it from the list and then click **Select Hot Key Combination**. In the dialog box that opens, select the key combination and then click **OK** or **Apply**.

— To reset all the default key combinations, click **Restore Defaults**.

Click **OK** or **Apply** to save the changes.

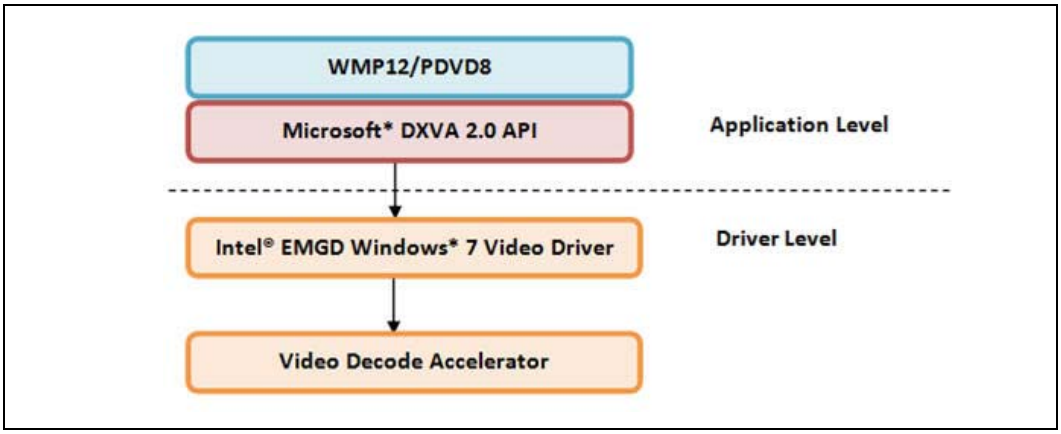
5.7 Enabling Hardware Accelerated Video Decode

Video decode is supported in the following players:

- Windows Media Player 12
- PowerDVD 8 build 3204

Figure 27 shows the video decode component stack for Intel® EMGD.

Figure 27. Windows* 7 Video Decode Component Stack



The entry points to hardware accelerated video decode are listed below, by player and format.

Table 22. Hardware Accelerated Video Decode Entry Points

Video Format	Entry Point	
	Windows Media Player 12	PowerDVD 8 build 3204
MPEG-2	VLD	VLD
VC-1	MC	VLD
WMV9	MC	VLD
H.264	VLD	VLD

Note: Decode of High Definition content at an acceptable frame rate requires the use of the VLD entry points; this cannot be accomplished using the legacy MC entry points.

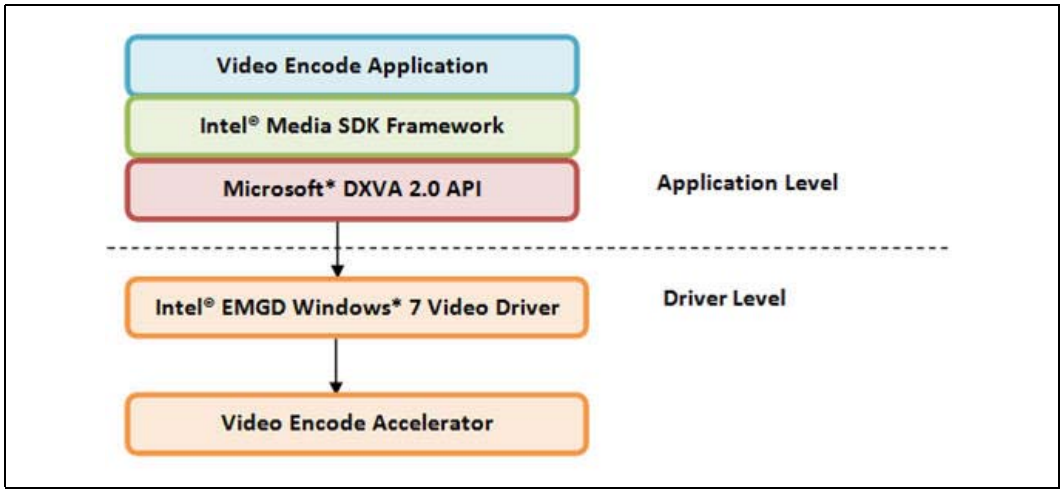
5.8 Enabling Hardware Accelerated Video Encode

5.8.1 Hardware Accelerated Video Encode Support

For Intel® EMGD for Windows* 7, the Intel® Atom™ Processor E6xx provides hardware accelerated video encode capability for H.264 video stream through the Intel® Media Software Development Kit (Intel® Media SDK) framework.

Figure 28 shows Intel® EMGD for Windows* 7 encode component stack on the Intel® Atom™ Processor E6xx platform. The video encoder application written for the Intel® Media SDK framework works on Intel® EMGD. The Intel® Media SDK interfaces with Microsoft* DXVA 2.0 and DDI extension to initiate hardware accelerated video encoding process on Intel® EMGD.

Figure 28. Windows* 7 Video Encode Component Stack



Intel® EMGD enables hardware accelerated video encoding. Source capture could come from:

- USB Camera, or
- Raw YUV file Input

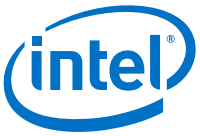
Table 23 summarizes the video encode support formats on the Intel® Atom™ Processor E6xx Windows* 7 platform

Table 23. Supported Video Encode Formats

Codec	Profile	Level	Max Bit Rate (bps)	Typical Picture and Frame Rate
H.264	BP	1b	128K	QCIF@15fps
H.264	BP	L1.1	192K	QCIF@30fps
H.264	BP	L1.2	384K	CIF@15fps or QVGA@20fps
H.264	BP	L2.0	2M	CIF@30fps or QVGA@30fps
H.264	BP	L3.0	10M	720*480@30fps or 720*576@25fps or VGA@30fps
H.264	MP*	L3.1	14M	1280*720@30fps

*The stream uses only tools common to the Baseline Profile that are also available on the Main Profile.

Note: Intel® US15W does not support video encode acceleration.



5.8.2 Video Encode through Sample Encoder Applications

Customers should write their own video encode applications based on the Intel® Media SDK sample encode applications.

1. Go to Intel® Media SDK website (http://registrationcenter-download.intel.com/akdlm/irc_nas/2008/w_MSDK_p_2.0.010_GOLD.zip)
2. Download Intel® Media SDK v2.0.

Note: Before using any sample application, Intel recommends first reading the Intel® Media SDK sample guide found in the `Doc` folder. Refer to the list of available sample applications detailed in the sample guide; however, customers should refer only to the `sample_encode` example. This is the console encode application currently supported on Intel® Atom™ Processor E6xx platform.

3. To run a sample encode application, either compile and run the sample folder that contains the sample reference code or run the pre-built executable included in the bin folder.

   Example:

   a. Open a console command prompt as administrator and go to sample folder that contains sample_encode.exe.

   b. To run sample_encode.exe, execute the following commands:

   sample_encode.exe h264 –nv12 –d3d –hw –i InputNV12File.yuv –o outputH264ElementaryStream.h264 –w 1280 –h 720

   Results of the commands:

   - Encode processing starts. The Frame number field increments every 100 frames.
   - Media SDK impl: hw (indicates hardware encode)
   - When encode processing ends, the H.264 elementary stream output is placed within the path defined by the **–o** option.

5.8.3 Video Encode with USB Camera

This sample application uses a Microsoft DirectShow* filter to work with a USB camera to encode both video and audio and then muxes the resulting stream to an MPEG-4 (.mp4) container. Note that audio is through software encoding instead of hardware.

1. Go to Intel® Media SDK website (http://software.intel.com/en-us/articles/media/)
2. Download Intel® Media SDK v3.0 (or later). Version 2.0 is not recommended due to DxShow plug-in's limitation for not supporting USB camera's output pixel format YUY2.

Note: Ensure the DxShow plug-in components are selected during the Media SDK setup process.

3. Install the GraphEdit tool. It is available in the Microsoft Windows SDK (http://go.microsoft.com/fwlink/?LinkId=62332).
4. Launch GraphEdit using `graphed.exe`, select **Graph**, and then **Insert Filter**.
5. Follow steps below to insert each filter component:

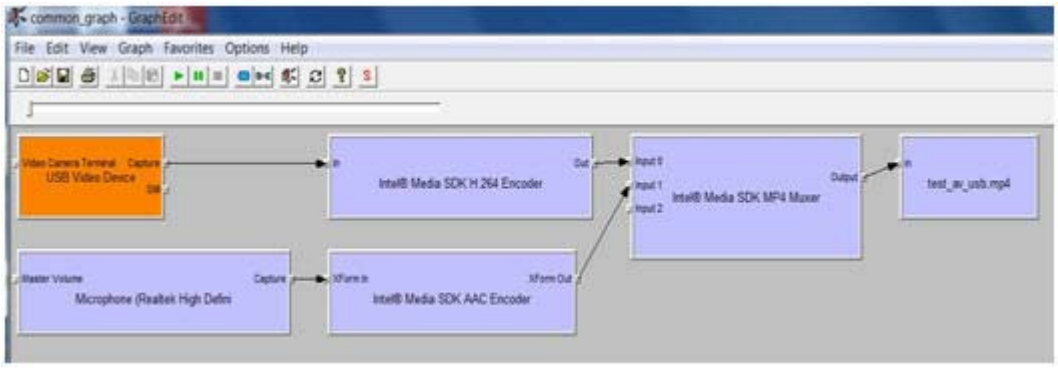
   a. Select the input of the raw audio and video stream from **Audio Capture Sources** and **Video Capture Sources**.

   b. Select Intel® Media SDK H.264 Encoder filter from **DirectShow Filters**.

   c. Select the audio encoder filter, for example Intel® Media SDK AAC Encoder from **DirectShow Filters**.

d. Select the muxer for audio + video encoded output, Intel® Media SDK MP4 Muxer from **DirectShow Filters**.

e. Select am MP4 container, File Writer from **DirectShow Filters**, and be sure to specify output file name (`.mp4`) and the save location.

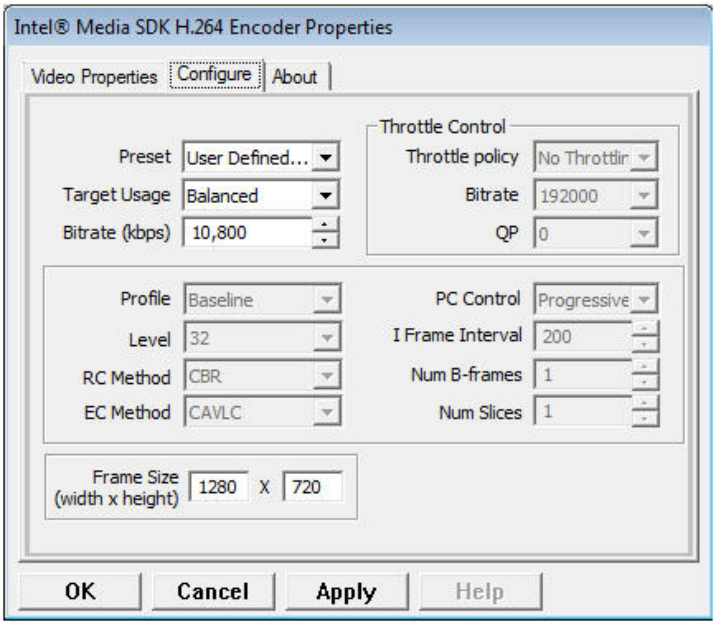


6. Connect the filters by dragging the mouse from one filter's output pin to another filter's input pin.

Note: If using Intel® Media SDK 2.0, the Intel® Media SDK H.264 encoder filter needs to be modified to convert the USB camera's YUY2 pixel format to the supported NV12 pixel format, otherwise an error will occur when connecting these two filters in GraphEdit. Contact your Intel representative for the filter's code changes support.

Using Intel® Media SDK 3.0 (or later), the Intel® Media SDK H.264 encoder filter supports USB camera's YUY2 pixel format and automatically converts to the supported NV12 pixel format of Intel® EMGD encode engine.

7. Configure the Intel® Media SDK H.264 Encoder Properties:
   - Profile: Only Baseline is supported
   - Level: Refer to Table 23, "Supported Video Encode Formats" on page 92 for the supported level.
   - RC Method: CBR or VBR
   - EC Method: Only CAVLC
   - Num B-frames: Must be 1 to indicate no B-frames



8. To change Intel® Media SDK H.264 Encoder configuration, go to the Registry Editor. The key entries are located at HKEY_CURRENT_USER -> Software -> Intel -> Media SDK Sample Filters
9. To start the encoding process, click **Play**. The resulting muxed stream is stored according to the path defined by the File Writer filter.
10. Play the captured video with PowerDVD 8 player or Windows Media Player 12.

Note: To verify that hardware accelerated video encode is used instead of software, check that `IsHWMfxLib` is set and `IsEncodePartiallyAccelerated` is cleared.

5.9 Diagnostic Tool

There is a utility located in `\TOOLS` named `emgd_crg.exe`. This utility gathers relevant Intel® EMGD information and creates a log file with it. For faster response, provide this file with requests for customer support.

5.10 Enable PortHotOverride Control via Registry Key

The `PortHotOverride` control is used to keep a specified display port constantly on, irrespective of whether the specified display monitor is connected.

Note: There is a potential risk in enabling this registry key. The default driver is designed to have unused ports closed rather than open/hot; in some rare cases it can do damage to the hardware. This is not a substitute for hot plugging and should not be used as such; repeated removals and connections will cause stress to the card.

Setting this registry key allows the system to boot up in headless (without a monitor) condition and then, when the monitor is plugged in, the display is visible. When a monitor is connected, the configuration information for the monitor should be already part of the driver.

Enable “Port Hot” Registry Location:

```
[HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\LPCO\PortHotOverride]
```

Enable “Port Hot” Key:

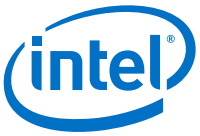
“DeviceToLeaveHot”=dword:0002 [or alternative value shown below]

Other potential DWORD values:

TMDS0	0x0001
RGB0	0x0002
CVBS0	0x0004
SVID0	0x0008
YPRPB0	0x0010
SCART0	0x0020
LVDS0	0x0040
TMDS1	0x0100
RGB1	0x0200
CVBS1	0x0400
SVID1	0x0800
YPRPB1	0x1000
SCART1	0x2000
LVDS1	0x4000
TV0	0x003C
TV1	0x3C00

Note: Only the VGA device RGB0 (0x0002) has been validated internally.

§ §



Appendix A Port Driver Attributes

A.1 Standard Port Driver Attributes

Port drivers are modules within the Intel® Embedded Media and Graphics Driver that control SCH-specific modules such as SCH LVDS, SCH TV or add-on modules to SCH. The table below lists the attributes available to port drivers. Some of these standard attributes can be customized for specific port drivers and are detailed in the following sections of this appendix.

In the following tables, device-specific (non-standard) attributes are highlighted in gray.

- "Internal LVDS Port Driver Attributes (Mobile chipsets only)" on page 98
- "HDMI Port Driver Attributes" on page 100
- "Chrontel CH7307 Port Driver Attributes" on page 100
- "Chrontel CH7308 Port Driver Attributes" on page 100
- "Chrontel CH7315/CH7319/CH7320 Port Driver Attributes" on page 101
- "Chrontel CH7022 Port Driver Attributes" on page 102
- "Chrontel CH7036 Port Driver Attribute" on page 103
- "Silicon Image SiI 1362/SiI 1364 Port Driver DVI Attributes" on page 103

Note: Not all standard attributes are supported by all port drivers. Please see the following sections for details on the specific attributes supported by each port driver. Flat panel settings are specified via the FPINFO options of the configuration; please see Table 17, "Parameter Configuration Format" on page 43.

Table 24. Standard Port Driver Attributes (Sheet 1 of 2)

Attribute Name	Attribute ID Number	Description
TVFORMAT	8	TV formats are device-specific
PANEL DEPTH	26	Can be either 18 or 24. 18 specifies 6-bit output per color, 24 specifies 8-bit output per color.
DUAL CHANNEL PANEL	27	Indicates whether the panel is dual channel panel. 0 = panel is not dual channel 1 = panel is dual channel Default = 0
SPREAD SPECTRUM CLOCKING	43	Spectrum Clocking
DITHER	45	Dither setting
PANEL PROTECT HSYNC	46	Horizontal sync panel protection
PANEL PROTECT VSYNC	47	Vertical sync panel protection
PANEL PROTECT PIXCLK	48	Pixel clock protection

Table 24. Standard Port Driver Attributes (Sheet 2 of 2)

Attribute Name	Attribute ID Number	Description
LVDS PANEL TYPE	49	This is used to select SPWG vs. OpenLDI panel types. 0 = SPWG; 1 = OpenLDI.
MAXIMUM INTENSITY	70	Provides a method to set maximum backlight intensity. It is not a method to turn on backlight but provides a way to adjust its value in percentages from minimum to maximum (100%). Any value above 100% will be defaulted to 100%. This is the maximum possible brightness. The backlight adjust slider when adjusted to maximum can only be up to this value.
INVERTER FREQUENCY	71	A method of controlling the backlight. It determines the number of time base events in total for a complete cycle of modulated backlight control.
MINIMUM INTENSITY	103	Provides an option to define the possible minimum value of the backlight intensity, the backlight adjustable slider bar (as shown in windows display properties) when adjusted to minimum can only be down to this value. Any setting of the intensity below this defined value will be reverted back to this Minimum Intensity value. If minimum backlight intensity is not set or defined, the default value is 4%. ***Note:*** This option is not a method to turn off backlight. The minimum backlight intensity is applicable to Windows OS only. It is not applicable for the firmware backlight intensity setting. Instead, use attribute 70 to configure firmware backlight intensity.

A.2 Port Driver Attributes

This section provides the supported attributes for each of the port drivers.

A.2.1 Internal LVDS Port Driver Attributes (Mobile chipsets only)

Table 25. Internal LVDS Port Driver Attributes (Sheet 1 of 2)

Attribute Name	Attribute ID	Description	Possible Ranges
PANEL DEPTH	26	Specify Panel Depth based on connected panel.	Default is 18, however, on some SCH chipsets 24-bit also is supported. For example,US15W supports both 18 and 24-bit outputs.
SPREAD SPECTRUM CLOCKING	43	Spectrum Clocking	Applicable for US15W only. Default = 0 Possible values: 3-9
DITHER	45	On and off Dithering	Dither=0 for 24-bit panels Dither=1 for 18-bit panels Default: • dither = 1 for 18-bit panels • dither = 0 for 24-bit panels.

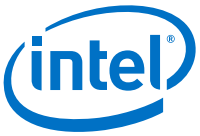


Table 25. Internal LVDS Port Driver Attributes (Sheet 2 of 2)

Attribute Name	Attribute ID	Description	Possible Ranges
LVDS PANEL TYPE	49	LVDS panel connector.	0 = SPWG formatted LVDS output (default) 1 = OpenLDI unbalanced color mapping output Default = 0
MAXIMUM INTENSITY	70	This attribute provides a method to set maximum backlight intensity. It is not a method to turn on backlight but provides a way to set its maximum value in percentages from minimum (4) to maximum (100%). Any value above 100% will be defaulted to 100%. This is the maximum possible intensity. It is set in percentages from 4% to 100%.	Valid range is 4-100%. Default is 100.
MINIMUM INTENSITY	103	This attribute provides a method to set minimum backlight intensity. It is not a method to turn off backlight but provides a way to set its value in percentages to minimum up to 4%. Any value less than 4% will be defaulted to 4%. It is possible to set percentages from 4% to 100%. Values < 4% would result in the screen being black if the brightness slider is set to the left-most position.	Valid range is 4-100%. Default is 4. ***Note:*** The minimum backlight intensity is applicable to Windows OS only. It is not applicable for firmware backlight intensity setting. Use attribute 70 to configure firmware backlight intensity.
INVERTER FREQUENCY	71	A method of controlling the backlight. It determines the number of time base events in total for a complete cycle of modulated backlight control.	Valid range is 0-65535 Hz. Typical value is 300 – 1000. Default depends on the board. Default is 20300 for Atom E6xx and US15W. For most other boards, default is 0. ***Note:*** For Atom E6xx platforms provided by Intel to EA customers, the inverter frequency and intensity need to be set.
BACKLIGHT LEGACY MODE	72	A method for controlling whether to use legacy mode for PWM duty cycle. Legacy mode is where the PWM duty cycle will be calculated using a combination of Backlight duty cycle and Legacy backlight Control (LBPC). In non-legacy mode, it will be calculated using Backlight duty cycle only.	Valid value is 0 for non-legacy mode.

A.2.2 HDMI Port Driver Attributes

A.2.2.1 Audio

The Intel® EMGD package does not include an HDMI audio driver, so you must obtain and install the driver yourself. The HDMI audio driver needs to support Intel HD Audio to be compatible with Intel® EMGD. You must also obtain Microsoft patch KB888111 to enable HDMI audio. Intel® EMGD supports only the Windows* HDMI audio driver.

A.2.2.2 sDVO-HDMI (CH7315)

Intel® EMGD supports only one type of sDVO-HDMI encoder, which is CH7315. sDVO-B cannot coexist with HDMI-B; sDVO-C cannot coexist with HDMI-C.

sDVO takes precedence over the HDMI port driver. If no sDVO encoder is available HDMI is automatically loaded by default (only in the GM45 Express chipset).

A.2.2.3 Internal HDMI

Internal HDMI is available only for the GM45 Express chipset. Only one HDMI port has audio at any one time. The first port in the port order has audio while the second port would have only display without audio.

Only one HDMI port has HDCP at any one time. The first port to receive a request for HDCP has HDCP enabled only in that port.

A.2.2.4 HDCP

HDCP is supported through the Certified Output Protection Protocol* (COPP) interface in Windows.

A.2.3 Chrontel CH7307 Port Driver Attributes

The table below shows the attributes for the Chrontel CH7307* port driver.

Note: For flat panel backlight timing settings, please see Table 17, “Parameter Configuration Format” on page 43.

A.2.4 Chrontel CH7308 Port Driver Attributes

The table below shows the attributes for the Chrontel CH7308* port driver.

Note: For FPINFO backlight timing settings, please see Table 17, “Parameter Configuration Format” on page 43.

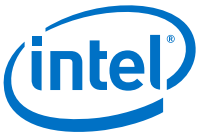


Table 26. Chrontel CH7308 Port Driver Attributes

Attribute Name	Attribute ID	Description	Possible Ranges
LVDS COLOR DEPTH	26	Panel depth	18 = 18 bits 24 = 24 bits Default = 18
DUAL CHANNEL PANEL	27	Indicates whether the panel is dual channel panel.	0 = panel is not dual channel 1 = panel is dual channel Default = 0
SPREAD SPECTRUM CLOCKING	43	Spectrum Clocking	0-15 Default = 7 Step = 1
DITHER	45	Dither setting	Default = 0
HSYNC PANEL PROTECTION	46	Horizontal sync panel protection	Default = 0
VSYNC PANEL PROTECTION	47	Vertical sync panel protection	Default = 0
PIXEL CLOCK PROTECTION	48	Pixel clock protection	Default = 0
LVDS PANEL TYPE	49	LVDS panel connector.	0 = SPWG formatted LVDS output (default) 1 = OpenLDI unbalanced color mapping output Default = 0

A.2.5 Chrontel CH7315/CH7319/CH7320 Port Driver Attributes

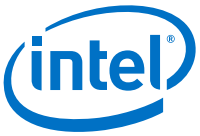
Note: For flat panel backlight timing settings, please see Table 17, “Parameter Configuration Format” on page 43.

A.2.6 Chrontel CH7022 Port Driver Attributes

The table below shows the attributes for the Chrontel CH7022 port driver.

Table 27. Chrontel CH7022 Port Driver Attributes

Attribute Name	Attribute ID	Description	Possible Ranges
TV OUTPUT FORMAT	8	TV formats are device-specific.	Default is NTSC-M (1). Supported standard TV formats: PD_TV_STD_NTSC_M 1 PD_TV_STD_NTSC_M_J 2 PD_TV_STD_NTSC_433 3 PD_TV_STD_PAL_B 4 PD_TV_STD_PAL_D 5 PD_TV_STD_PAL_G 6 PD_TV_STD_PAL_H 7 PD_TV_STD_PAL_I 8 PD_TV_STD_PAL_M 9 PD_TV_STD_PAL_N 10 PD_TV_STD_PAL_60 12 PD_TV_STD_SECAM_B 13 PD_TV_STD_SECAM_D 14 PD_TV_STD_SECAM_G 15 PD_TV_STD_SECAM_K 16 PD_TV_STD_SECAM_K1 17 PD_TV_STD_SECAM_L 18 Supported HDTV formats: PD_HDTV_STD_SMPTE_274M_1080i50 24 PD_HDTV_STD_SMPTE_274M_1080i59 25 PD_HDTV_STD_SMPTE_274M_1080i60 26 PD_HDTV_STD_SMPTE_274M_1080p60 34 PD_HDTV_STD_SMPTE_296M_720p59 37 PD_HDTV_STD_SMPTE_296M_720p60 38 PD_HDTV_STD_SMPTE_296M_720p50 39 PD_HDTV_STD_SMPTE_293M_480p59 40 PD_HDTV_STD_SMPTE_170M_480i59 41 PD_HDTV_STD_ITURBT601_576i50 42 PD_HDTV_STD_ITURBT601_576p50 43 PD_HDTV_STD_EIA_7702A_480p60 45



A.2.7 Chrontel CH7036 Port Driver Attribute

The table below shows the attributes for the Chrontel CH7036 port driver.

Table 28. Chrontel CH7036 Port Driver Attributes

Attribute Name	Attribute ID	Description	Possible Ranges
H POSITION	4	Horizontal position adjustment for VGA output	0-4096 2048 (Default)
V POSITION	5	Vertical position adjustment for VGA output	0-4096 2048 (Default)
H SCALE	6	Horizontal display image size adjustment. Does not apply if video output is bypassed.	1 - 20 15 (HDMI Default) ***Note:*** If CRT is detected, CRT Default (18) is used.
V SCALE	7	Vertical display image size adjustment. Do not apply if video output is bypass	1 - 20 15 (HDMI Default) ***Note:*** If CRT is detected, CRT Default (18) is used.
Display Channel	9	Display output channel selection.	Possible Range: 1- Auto-Detect (Default) 2 -LVDS+HDMI 3- LVDS+DVI 4- LVDS+VGA 5- HDMI 6- DVI 7- VGA
DITHER SEL	45	Enable CH7036 LVDS panel dithering function if QUALITY ENHANCEMENT is disabled.	0: for 18-bit input -> 18-bit panel (default) 1: for 18-bit input -> 24-bit panel 2: for 24-bit input -> 18 bit panel 3: for 24 bit input -> 24-bit panel
AUDIO TYPE	89	Input audio format select	0 - SPDIF (Default) 1 - I2S
QUALITY ENHANCEMENT	93	CH7036 LVDS dithering bypass function enable. If enabled, DITHER SEL is ignored.	0 - Disable 1 - Enable (Default)

A.2.8 Silicon Image SiI 1362/SiI 1364 Port Driver DVI Attributes

Note: For flat panel backlight timing settings, please see Table 17, “Parameter Configuration Format” on page 43.

A.3 Chipset and Port Driver-specific Installation Information

A.3.1 Default Search Order

Note: See more information pertaining to port order in the description for Table 17, “Parameter Configuration Format” on page 43.

Table 29. Default Search Order

Chipset	Default Search Order
Intel® Atom™ Processor E6xx	LVDS, sDVOB
Intel® US15W/US15WP/WPT	LVDS, sDVOB

A.3.2 Default GPIO Pin Pair Assignments

Table 30. Default GPIO Pin Pair Assignments

Chipset	Default GPIO Pin Pair for EDID	
	sDVOB	LVDS
Intel® Atom™ Processor E6xx	4	2
Intel® US15W/WP/WPT	4	2

A.3.3 Default I2C Device Address Byte Assignment

Table 31. Default I²C Device Address Byte Assignment

Port Driver	Default Device Address Bytes (DAB)
CH7315, CH7317, CH7319, CH7320, CH7022	0x70 (for first sDVO device)
CH7307	0x70 (for first sDVO device)
CH7308	0x70 (for first sDVO device)
Sil 1362	0x70 (for first sDVO device)
Sil 1364	0x70 (for first sDVO device)

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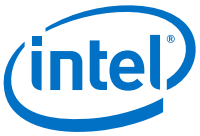

Appendix B 2D/3D API Support

This appendix provides information on supported and non-supported OpenGL and OpenGL ES APIs.

B.1 2D Support

Intel® EMGD provides 2D capabilities on Windows through DirectX*/GDI and GDI+.

B.2 3D Support

Intel® EMGD provides 3D capabilities on Windows* 7 and Windows Embedded Standard* 7 through several industry-standard APIs, such as OpenGL and Direct3D. These APIs are described in the following sections.

B.2.1 OpenGL APIs

The following OpenGL versions are supported:

- Version 2.0 on US15W/US15WP/WPT
- Intel® Atom™ Processor E6xx

For general OpenGL information, visit http://www.opengl.org/about/overview/.

Table 32. Supported Intel® OpenGL APIs (Sheet 1 of 3)

GL_ARB_fragment_program
GL_ARB_vertex_program
GL_ARB_depth_texture
GL_ARB_shadow
GL_NV_blend_square
GL_EXT_multi_draw_arrays
GL_ARB_multitexture
GL_ARB_shader_objects
GL_ARB_shading_language_100
GL_ARB_texture_border_clamp
GL_ARB_texture_compression
GL_ARB_texture_cube_map
GL_ARB_texture_env_add
GL_ARB_texture_env_combine
GL_ARB_texture_env_crossbar
GL_ARB_texture_env_dot3
GL_ARB_texture_non_power_of_two

Table 32. Supported Intel® OpenGL APIs (Sheet 2 of 3)

GL_ARB_transpose_matrix
GL_EXT_abgr
GL_EXT_bgra
GL_EXT_blend_color
GL_EXT_blend_func_separate
GL_EXT_blend_minmax
GL_EXT_blend_subtract
GL_EXT_compiled_vertex_array
GL_EXT_fog_coord
GL_EXT_packed_pixels
GL_EXT_rescale_normal
GL_EXT_secondary_color
GL_EXT_separate_specular_color
GL_EXT_stencil_two_side
GL_EXT_texture_compression_s3tc
GL_EXT_texture_env_add
GL_EXT_texture_env_combine
GL_EXT_texture_filter_anisotropic
GL_ARB_vertex_buffer_object
GL_ARB_occlusion_query
GL_ARB_fragment_shader
GL_ARB_point_sprite
GL_EXT_texture_lod_bias
GL_ARB_multisample
GL_ARB_draw_buffers
GL_ARB_point_parameters
GL_ARB_texture_mirrored_repeat
GL_ARB_window_pos
GL_EXT_blend_equation_separate
GL_EXT_draw_range_elements
GL_EXT_stencil_wrap
GL_EXT_texture3D
GL_EXT_texture_edge_clamp
GL_EXT_texture_env_dot3
GL_EXT_texture_object
GL_EXT_vertex_array
GL_NV_texgen_reflection
GL_SGIS_generate_mipmap
GL_ARB_matrix_palette
GL_ARB_shadow_ambient
GL_ARB_vertex_blend

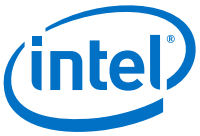

Table 32. Supported Intel® OpenGL APIs (Sheet 3 of 3)

GL_ARB_vertex_shader
GL_EXT_texture_cube_map
WGL_EXT_extensions_string

Table 33. Non-Supported Intel OpenGL APIs (Sheet 1 of 2)

GL_ARB_color_buffer_float
L_3DFX_texture_compression_FXT1
GL_EXT_clip_volume_hint
GL_EXT_cull_vertex
GL_IBM_texture_mirrored_repeat
GL_WIN_swap_hint
WGL_ARB_buffer_region
WGL_ARB_extensions_string
WGL_ARB_pixel_format
WGL_ARB_pbuffer
WGL_ARB_make_current_read
WGL_EXT_swap_control
GL_EXT_shadow_funcs
GLX_ARB_get_proc_address
GL_ARB_vertext_shader
GLX_SGI_swap_control
GLX_MESA_swap_control (Linux Specific)
GL_ARB_fragment_program_shadow
GL_EXT_paletted_texture
Mesa 3-D graphics library 7.1
GLX_EXT_texture_from_pixmap
GL_EXT_framebuffer_object
GLX_ARB_multisample
GLX_EXT_visual_info
GLX_EXT_visual_rating
GLX_EXT_import_context LINPB
GLX_OML_swap_method
GLX_SGI_make_current_read
GLX_SGIS_multisample
GLX_SGIX_hyperpipe
GLX_SGIX_swap_barrier
GLX_SGIX_fbconfig
GLX_MESA_copy_sub_buffer
GLX_MESA_allocate_memory
GLX_MESA_swap_frame_usage
GLX_OML_sync_control

Table 33. Non-Supported Intel OpenGL APIs (Sheet 2 of 2)

GLX_SGI_swap_control
GLX_SGI_video_sync
GLX_SGIX_pbuffer
GLX_SGIX_visual_select_group
GL_ARB_pixel_buffer_object
GL_ARB_shading_language_120
GL_ARB_texture_rectangle
GL_EXT_blend_logic_op
GL_EXT_copy_texture
GL_EXT_framebuffer_object
GL_EXT_framebuffer_blit
GL_EXT_pixel_buffer_object
GL_EXT_point_parameters
GL_EXT_polygon_offset
GL_EXT_subtexture
GL_EXT_texture
GL_EXT_texture_mirror_clamp
GL_EXT_texture_rectangle
GL_APPLE_packed_pixels
GL_ATI_blend_equation_separate
GL_ATI_separate_stencil
GL_IBM_rasterpos_clip
GL_INGR_blend_func_separate
GL_MESA_ycbcr_texture
GL_MESA_window_pos
GL_NV_light_max_exponent
GL_NV_point_sprite
GL_NV_texture_rectangle
GL_OES_read_format
GL_SGI_color_matrix
GL_SGIS_texture_border_clamp
GL_SGIS_texture_edge_clamp
GL_SGIS_texture_lod
GL_SUN_multi_draw_arrays

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Appendix C Intel® 5F Extended Interface Functions

The BIOS provides a set of proprietary function calls to control operation of the extended features. These function calls all use AH = 5Fh in their designed interface for easy identification as a proprietary function.

These functions are designed to maintain maximum compatibility with the Desktop and Mobile Video BIOS. As such many of the definitions behave identically. When the behavior of the Embedded Video BIOS is not identical to the Desktop and Mobile Video BIOS it is noted.

In addition to these 5F functions, the Video BIOS also supports all 4F functions defined by the *VESA BIOS Extension (VBE) Core Functions Standard, Version 3.0* with the exception of the 0A function (Return VBE Protected Mode Interface). All other functions, from 00 through 09 and 0B are supported by the Video BIOS. The *VESA BIOS Extension (VBE) Core Functions Standard, Version 3.0* document is available from http://www.vesa.org/vesa-standards/free-standards/

The table below provides a summary of the Intel® EMGD supported Intel 5F functions.

Table 34. Summary of Intel 5F Extended Interface Functions (Sheet 1 of 2)

Function	Function Name	Description	Page
BIOS Extended Interface Functions			
5F01h	Get Video BIOS Information	Gets VBIOS Build Information.	110
5F05h	Refresh Rate	Sets a new vertical refresh rate for a given mode and returns the current vertical refresh rate	110
5F10h	Get Display Memory Information	Returns information about the linear memory.	112
5F1Ch	BIOS Pipe Access	Sets the BIOS pipe access and returns the BIOS pipe access status.	112
5F29h	Get Mode Information	Returns information on the requested mode.	112
5F61h	Local Flat Panel Support Function	Supports local flat panel features.	113
5F68h	System BIOS Callback	Allows SoftBIOS to do any system callbacks through INT 15h	114
Hooks for the System BIOS			
5F31h	POST Completion Notification Hook	Signals the completion of video POST (Power On Self Test)	114
5F33h	Hook After Mode Set	Allows System BIOS to intercept Video BIOS at the end of a mode set.	114
5F35h	Boot Display Device Hook	Allows System BIOS to override video display default setting.	115
5F36h	Boot TV Format Hook	Allows System BIOS to boot TV in selected TV format state.	116

Table 34. Summary of Intel 5F Extended Interface Functions (Sheet 2 of 2)

Function	Function Name	Description	Page
5F38h	Hook Before Set Mode	Allows System BIOS to intercept Video BIOS before setting the mode.	116
5F40h	Config ID Hook	Allows System BIOS to supply a configuration ID that is passed to the driver.	117

C.1 BIOS Extended Interface Functions

The BIOS provides a set of proprietary function calls to control operation of the extended features. These function calls all use AH = 5Fh in their designed interface for easy identification as a proprietary function

These functions are designed to maintain maximum compatibility with the Desktop and Mobile Video BIOS. As such many of the definitions behave identically. When the behavior of the Embedded Video BIOS is not identical to the Desktop and Mobile Video BIOS it is noted.

C.1.1 5F01h – Get Video BIOS Information

This function returns the Video BIOS Build information.

Note: This function is an extension of the Desktop and Mobile Video BIOS. If register ECX does not contain ASCII characters “IEGD” then the VBIOS is not described by this specification.

Calling Register:

AX = 5F01h, Get Video Information function

Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
EBX = 4 bytes Video BIOS Build Number ASCII string, e.g., ‘1000’
ECX = 4 bytes Embedded Identifier, ASCII string ‘IEGD’

C.1.2 5F05h – Refresh Rate

This function sets a new vertical refresh rate for a given mode and returns the current vertical refresh rate and available refresh rate for a given non-VGA mode.

C.1.2.1 5F05h, 00h – Set Refresh Rate

This sub-function sets a new default refresh rate for the selected pipe. If the mode is currently active, the CRT controller and other registers will be automatically programmed setting the requested refresh rate.

Note: This function is not entirely compatible with the Desktop and Mobile versions. It is not possible to set the refresh rate for a given mode in advance. This function sets the “desired” refresh rate which will be applied to all subsequent mode sets when possible. If the mode provided in BL is the current mode, then a mode change will be automatically performed.

Calling Register:

AX = 5F05h, Refresh Rate function
BH = 00h, Set Refresh Rate sub-function
BL = Mode Number
ECX = Refresh rate (indicated by setting one bit):
Bits 31 - 9 = Reserved
Bit 8 = 120 Hz
Bit 7 = 100 Hz
Bit 6 = 85 Hz
Bit 5 = 75 Hz
Bit 4 = 72 Hz
Bit 3 = 70 Hz
Bit 2 = 60 Hz
Bit 1 = 56 Hz
Bit 0 = 43 Hz (Interlaced - Not supported)

Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed

C.1.2.2 5F05h, 01h – Get Refresh Rate

This sub-function returns current vertical refresh rate for the selected pipe and available refresh rates information for a given Non-VGA mode.

Note: This sub-function returns a status of supported but failed (AX = 015Fh) if executed with a standard VGA mode.

Calling Registers:

AX = 5F05h, Refresh Rate function
BH = 01h, Get Refresh Rate sub-function
BL = Mode number

Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
EBX = Available refresh rates (indicated by one or more bits set):
Bits 31 - 9 = Reserved
Bit 8 = 120 Hz
Bit 7 = 100 Hz
Bit 6 = 85 Hz
Bit 5 = 75 Hz
Bit 4 = 72 Hz
Bit 3 = 70 Hz
Bit 2 = 60 Hz
Bit 1 = 56 Hz
Bit 0 = 43 Hz (Interlaced - Not supported)
ECX = Current refresh rate (see EBX for bit definitions)

C.1.3 5F10h – Get Display Memory Information

This function returns information regarding the linear memory starting address, size and memory mapped base address.

Calling Register:

AX = 5F10h, Get Linear Display Memory Information function

Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
ESI = Display memory base address
ECX = Total physical display memory size (in bytes)
EDX = Available display memory size (in bytes)
EDI = Memory Mapped I/O Base Address
EBX = Stride (memory scan line width in bytes)

C.1.4 5F1Ch – BIOS Pipe Access

This function will set the BIOS pipe access or return the BIOS pipe access status.

C.1.4.1 5F1Ch, 00h – Set BIOS Pipe Access

This sub-function will set the currently selected pipe. All 5f functions operate on the currently selected pipe.

When not in clone modes this value cannot be set.

Calling Registers:

AX = 5F1Ch, BIOS Pipe Access function
BH = 00h, Set BIOS Pipe Access sub-function
CH = BIOS Pipe access:
= 00h, Pipe A
= 01h, Pipe B

Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed

C.1.4.2 5F1Ch, 01h – Get BIOS Pipe Access

This sub-function will return the currently selected pipe.

Calling Registers:

AX = 5F1Ch, BIOS Pipe Access function
BH = 01h, Get BIOS Pipe Access sub-function

Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
CH = BIOS Pipe access:
= 00h, Pipe A
= 01h, Pipe B

C.1.5 5F29h – Get Mode Information

This function returns the requested mode's resolution, color depth, and maximum required bandwidth using its current refresh rate. This function is applied to extended-graphics modes only. If the mode number is not an extended graphics mode, the function will return failure.

Calling Registers:

AX = 5F29h, Get Mode Information function
BH = Mode To Use:
= 80h, Current Mode
= 00h - 7Fh, Given Mode Number

Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
EBX bits 31 - 16 = Mode horizontal (X) resolution in pixels
EBX bits 15 - 0 = Mode vertical (Y) resolution in pixels
ECX bits 31 - 16 = Maximum bandwidth in megabytes per second
ECX bits 15 - 0 = Color depth in bits per pixel

C.1.6 5F61h – Local Flat Panel Support Function

This function supports local flat panel only features.

Note: Only Subfunction 5h of the 5f61h interface is supported for the Embedded VBIOS.

C.1.6.1 5F61h, 05h – Get Configuration ID

This function is used to return the Configuration ID.

Note: This function is known as “Get Local Flat Panel Number” in the Desktop and Mobile Video BIOS. This function performs a similar purpose however, the configuration IDs have no pre-defined meaning. The Configuration ID is reported to the Intel® EMGD.

Calling Registers:

AX = 5F61h, Local Flat Panel Support function
BH = 05h, Get Config ID Subfunction

Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
BL = Config ID

C.1.7 5F68h – System BIOS Callback

This is a generic function that allows SoftBIOS to do any system callbacks through INT 15h. The Input/Output of this function is dependent on the definition of the desired INT 15h hook except for the EAX register.

Calling Registers:

AX = 5F68h, System BIOS Callback Function
EAX bits 31:16 = System BIOS INT 15h Hook Function

Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed

C.2 Hooks for the System BIOS

The video BIOS performs several system BIOS interrupt function calls (interrupt 15h hooks). Each function provides the system BIOS with the opportunity to gain control at specific times to perform any custom processing that may be required. After each interrupt hook, the system BIOS must return control to the video BIOS. INT 10h calls could be made within the INT 15h hook calls provided that it is not recursive and thus cause a deadlock.

C.2.1 5F31h – POST Completion Notification Hook

This hook signals the completion of video POST (Power On Self Test). The hook executes after the sign-on message is displayed and PCI BIOS resizing.

Calling Registers:

AX = 5F31h, POST Completion Notification Hook

Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 015Fh, Function supported but failed
= 005Fh, Function supported and successful

C.2.2 5F33h – Hook After Mode Set

This hook allows the system BIOS to intercept the video BIOS at the end of a mode set.

Calling Registers:

AX = 5F33h, Hook After Mode Set
BH = Number of character columns
BL = Current mode number
CH = Active display page

Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 015Fh, Function supported but failed
= 005Fh, Function supported and successful

C.2.3 5F35h – Boot Display Device Hook

This hook allows the system BIOS to override the video display default setting. The graphics BIOS will set the returned video display during POST (power up initialization).

Note: This function is not entirely compatible with the Desktop and Mobile Video BIOS. The bits in CL have a configurable mapping to the Port Numbers as defined in Section 4.0, "Video Firmware" on page 55. The assigned meanings used in the Desktop specification can be duplicated with a correct configuration. The values below are the default values if no "Common To Port" mapping is provided.

Calling Registers:

AX = 5F35h, Boot Display Device Hook

Return Registers:

```
AX = Return Status (function not supported if AL != 5Fh);
     = 005Fh, Function supported and successful
     = 015Fh, Function supported but failed
CL = Display Device Combination to boot (1 = Enable display,
          0 = Disable display):
     = 00h, VBIOS Default
     Bit 7 - 6 = Reserved
     Bit 5 = Port 5 (or common_to_port[5])
     Bit 4 = Port 4 (or common_to_port[4])
     Bit 3 = Port 3 (or common_to_port[3])
     Bit 2 = Port 2 (or common_to_port[2])
     Bit 1 = Port 1 (or common_to_port[1])
     Bit 0 = Port 0 (or common_to_port[0])
```

C.2.4 5F36h – Boot TV Format Hook

This hook allows the system BIOS to boot TV in selected TV format state.

Calling Registers:

AX = 5F36h, Boot TV Format Hook

Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 015Fh, Function supported but failed
= 005Fh, Function supported and successful
BL = TV Format requested:
= 00h, No Preference
= 01h, NTSC_M
= 02h, NTSC_M_J
= 03h, NTSC_433
= 04h, PAL_B
= 05h, PAL_D
= 06h, PAL_G
= 07h, PAL_H
= 08h, PAL_I
= 09h, PAL_M
= 2Ah, PAL_N
= 18h, PAL_60
= 12h, SECAM_L
= 0Dh, SECAM_B
= 0Eh, SECAM_D
= 0Fh, SECAM_G
= 10h, SECAM_K
= 11h, SECAM_K1

C.2.5 5F38h – Hook Before Set Mode

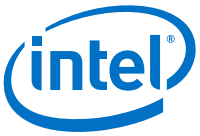
This hook allows the system BIOS to intercept the video BIOS before setting the mode.

Calling Registers:

AX = 5F38h, Hook Before Set Mode
CL = New video mode to be set

Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 015Fh, Function supported but failed
= 005Fh, Function supported and successful



C.2.6 5F40h – Config ID Hook

This function is known as “Boot Panel Type Hook” in the Desktop and Mobile Video BIOS. It allows the system BIOS to supply a configuration ID that will eventually be passed to the driver. This configuration ID is unused by the Video BIOS; however, it alters the behavior of the driver as described in Section 4.0, “Video Firmware” on page 55.

Calling Registers:

AX = 5F40h, Config ID Hook

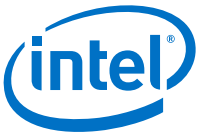
Return Registers:

AX = Return Status (function not supported if AL != 5Fh):
= 005Fh, Function supported and successful
= 015Fh, Function supported but failed
CL = Configuration ID

§ §

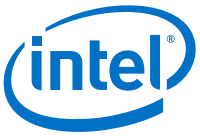
Appendix D Example INF File

```
;==========================================================================
;
; Copyright (c) Intel Corporation (2013).
;
; INTEL MAKES NO WARRANTY OF ANY KIND REGARDING THE CODE.  THIS CODE IS
; LICENSED ON AN "AS IS" BASIS AND INTEL WILL NOT PROVIDE ANY SUPPORT,
; ASSISTANCE, INSTALLATION, TRAINING OR OTHER SERVICES.  INTEL DOES NOT
; PROVIDE ANY UPDATES, ENHANCEMENTS OR EXTENSIONS.  INTEL SPECIFICALLY
; DISCLAIMS ANY WARRANTY OF MERCHANTABILITY, NONINFRINGEMENT, FITNESS FOR ANY
; PARTICULAR PURPOSE, OR ANY OTHER WARRANTY.  Intel disclaims all liability,
; including liability for infringement of any proprietary rights, relating to
; use of the code. No license, express or implied, by estoppel or otherwise,
; to any intellectual property rights is granted herein.
;
;==========================================================================

;==========================================================================
; Installation inf for the Intel Corporation graphics adapter.
[Version]
Signature="$WINDOWS NT$"
Provider=%Intel%
ClassGUID={4D36E968-E325-11CE-BFC1-08002BE10318}
Class=Display
;8.14.xx.xxxx Win7 & later DX9
;8.15.xx.xxxx Win7 & DX10
DriverVer=03/10/2011,8.14.180.1889
;CatalogFile=Poulsbo.cat  ; required for WHQL digital signature

;==========================================================================
[DestinationDirs]
DefaultDestDir   = 11
igd.Miniport  = 12  ; drivers
igd.UserMode  = 11  ; system32
igd.ICD      = 11  ; system32
igd.MSDK  = 11  ; system32
CUI.Copy = 11
OPM.Copy = 11
Resource.Copy = 11 ; system32

;==========================================================================
;
; Driver information
;

;==========================================================================
[Manufacturer]
%Intel%   = Intel.Mfg,NTx86.6.1

;==========================================================================
;[Intel.Mfg]
; Leave this blank since we don't support anything other than 32-bit Win7

[Intel.Mfg.NTx86.6.1] ;32-bit Win7
%Intel% %i900G0%  = igd_plb, PCI\VEN_8086&DEV_8108
```



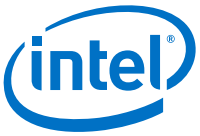
```
%Intel% %iTNC0%   = igd_tnc, PCI\VEN_8086&DEV_4108

;=============================================================================
[igd_plb.GeneralConfigData]
MaximumNumberOfDevices = 2
MaximumDeviceMemoryConfiguration = 256

;=============================================================================
[igd_tnc.GeneralConfigData]
MaximumNumberOfDevices = 2
MaximumDeviceMemoryConfiguration = 256

;=============================================================================
;
; General installation section
;
;=============================================================================
[igd_plb]
FeatureScore=F6   ; required for WDDM
CopyFiles = igd.Miniport, igd.UserMode, igd.ICD, CUI.Copy, OPM.Copy, Resource.Copy
AddReg = igd_SoftwareDeviceSettings_plb, CUI.AddReg
DelReg = igd_SoftwareDeviceSettings_plb, CUI.DelReg
RegisterDlls = CUISDK_Registration

;=============================================================================
[igd_tnc]
FeatureScore=F6   ; required for WDDM
CopyFiles = igd.Miniport, igd.UserMode, igd.ICD, igd.MSDK, CUI.Copy, OPM.Copy,
Resource.Copy
AddReg = igd_SoftwareDeviceSettings_tnc, CUI.AddReg
DelReg = igd_SoftwareDeviceSettings_tnc, CUI.DelReg
RegisterDlls = CUISDK_Registration


;=============================================================================
;
; File sections
;
[igd.Miniport]
igdkmd32.sys

[igd.UserMode]
igdumd32.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME

[igd.ICD]
igdsgl32.dll
igdogl32.dll

[igd.MSDK]
libmfxhw32.dll

[OPM.Copy]
igdkmd32.vp
igd_XC.vp
igd_XO.vp
igd_XA.cpa
igd_XA.vp

[CUI.Copy]
hccutils.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxsrvc.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxsrvc.exe,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxpph.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxcpl.cpl,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxcfg.exe,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxdo.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxtray.exe,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
```

```
hkcmd.exe,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxres.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME
igfxress.dll,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME     ; Generic language
resource file
IgfxExtps.dll,,,0x00004000 ; COPYFLG_IN_USE_TRY_RENAME
IgfxExt.exe,,,0x00004000  ; COPYFLG_IN_USE_TRY_RENAME

[Resource.Copy]
igfxrENU.lrc
igfxressENU.lrc

;=============================================================================
[CUI.DelReg]
HKLM,%CUIDeviceIndependentKey%
HKLM,%DisplayKey%
; Delete old style cui keys which are device dependent
HKLM,Software\INTEL\igfxcui
HKR,igfxcfg
HKR,igfxcpl
HKR,igfxpph
HKR,igfxsrvc
HKR,igfxhk
HKR,hkcmd
HKR,igfxtray
HKR,shellex\PropertySheetHandlers

;=============================================================================
; Delete the CUI registry entry which registers for winlogon events
;
HKLM,"SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon\Notify\igfxcui"

;=============================================================================
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

;=============================================================================
;CUIService

HKCR,"igfx.CUIService\CLSID"
HKCR,"igfx.CUIService\CurVer"
HKCR,"igfx.CUIService"
HKCR,"igfx.CUIService.1\CLSID"
HKCR,"igfx.CUIService.1"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}\InProcServer32\ThreadingModel"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}\InProcServer32"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}\ProgID"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}\Programmable"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}\VersionIndependentProgID"
HKCR,"CLSID\{0F195FA1-CCF0-11D2-8B20-00A0C93CB1F4}"

;=============================================================================
;igfxhk.Hotkey

HKCR,"igfxhk.HotKey\CLSID"
HKCR,"igfxhk.HotKey\CurVer"
HKCR,"igfxhk.HotKey"
HKCR,"igfxhk.HotKey.1\CLSID"
HKCR,"igfxhk.HotKey.1"
HKCR,"CLSID\{235CC099-CFB4-44D9-8228-270FEE479D8A}\InProcServer32\ThreadingModel"
HKCR,"CLSID\{235CC099-CFB4-44D9-8228-270FEE479D8A}\InProcServer32"
HKCR,"CLSID\{235CC099-CFB4-44D9-8228-270FEE479D8A}\ProgID"
HKCR,"CLSID\{235CC099-CFB4-44D9-8228-270FEE479D8A}\VersionIndependentProgID"
HKCR,"CLSID\{235CC099-CFB4-44D9-8228-270FEE479D8A}"

;=============================================================================
;Remove HKLM\Software\Microsoft\Windows\Currentversion\Run CUI entries
HKLM,"SOFTWARE\Microsoft\Windows\CurrentVersion\Run","HotKeysCmds"
HKLM,"SOFTWARE\Microsoft\Windows\CurrentVersion\Run","IgfxTray"
```



```
HKLM,"SOFTWARE\Microsoft\Windows\CurrentVersion\Run","IgfxExt"

;=============================================================================
;
; Service Installation
;
[igd_plb.Services]
AddService = igd, 0x00000002, igd_Service_Inst, igd_EventLog_Inst

[igd_tnc.Services]
AddService = igd, 0x00000002, igd_Service_Inst, igd_EventLog_Inst


;=============================================================================
[igd_Service_Inst]
ServiceType    = 1               ; SERVICE_KERNEL_DRIVER
StartType      = 3               ; SERVICE_DEMAND_START
ErrorControl   = 0                ; SERVICE_ERROR_IGNORE
LoadOrderGroup = Video
ServiceBinary  = %12%\igdkmd32.sys

;=============================================================================
[igd_EventLog_Inst]
AddReg = igd_EventLog_AddReg

;=============================================================================
[igd_EventLog_AddReg]
HKR,,EventMessageFile,0x00020000,"%SystemRoot%"\System32\IoLogMsg.dll;%SystemRoot%
"\System32\drivers\igdkmd32.sys"
HKR,,TypesSupported,0x00010001,7D3D

;=============================================================================
;
; Software Installation
;
[igd_SoftwareDeviceSettings_plb]
HKR,, UserModeDriverName,    %REG_MULTI_SZ%, igdumd32.dll
HKR,, InstalledDisplayDrivers,    %REG_MULTI_SZ%, igdumd32
HKR,, UserModeDriverGUID,  %REG_SZ%,{"A37D3D79-C3DB-4270-A0D6-72F8AB8F511D"}
HKLM, "SYSTEM\CurrentControlSet\Control\GraphicsDrivers",  UseXPModel,
%REG_DWORD%,  0
HKR,, OpenGLDriverName,            %REG_MULTI_SZ%, igdogl32.dll
HKR,, OpenGLVersion,               %REG_DWORD%,    1
HKR,, OpenGLFlags,                 %REG_DWORD%,    1

HKR,, PcfVersion,    %REG_DWORD%, 0x0700

HKR,, ConfigId, %REG_DWORD%, 1

HKR, ALL\1 , name, %REG_SZ%, "US15"
HKR, ALL\1\General , DisplayConfig, %REG_DWORD%, 1
HKR, ALL\1\General , PortOrder, %REG_SZ%, "24000"
HKR, ALL\1\Port\4\General , name, %REG_SZ%, "LVDS10x7"
HKR, ALL\1\Port\4\General , Rotation, %REG_DWORD%, 0
HKR, ALL\1\Port\4\General , Edid, %REG_DWORD%, 1
HKR, ALL\1\Port\4\General , EdidAvail, %REG_DWORD%, 3
HKR, ALL\1\Port\4\General , EdidNotAvail, %REG_DWORD%, 4
HKR, ALL\1\Port\4\FpInfo , bkltmethod, %REG_DWORD%, 1
HKR, ALL\1\Port\4\FpInfo , BkltT1, %REG_DWORD%, 60
HKR, ALL\1\Port\4\FpInfo , BkltT2, %REG_DWORD%, 200
HKR, ALL\1\Port\4\FpInfo , BkltT3, %REG_DWORD%, 200
HKR, ALL\1\Port\4\FpInfo , BkltT4, %REG_DWORD%, 50
HKR, ALL\1\Port\4\FpInfo , BkltT5, %REG_DWORD%, 400
HKR, ALL\1\Port\4\Dtd\1 , PixelClock, %REG_DWORD%, 65000
HKR, ALL\1\Port\4\Dtd\1 , HorzActive, %REG_DWORD%, 1024
HKR, ALL\1\Port\4\Dtd\1 , HorzSync, %REG_DWORD%, 24
HKR, ALL\1\Port\4\Dtd\1 , HorzSyncPulse, %REG_DWORD%, 136
```

```
HKR, ALL\1\Port\4\Dtd\1 , HorzBlank, %REG_DWORD%, 320
HKR, ALL\1\Port\4\Dtd\1 , VertActive, %REG_DWORD%, 768
HKR, ALL\1\Port\4\Dtd\1 , VertSync, %REG_DWORD%, 3
HKR, ALL\1\Port\4\Dtd\1 , VertSyncPulse, %REG_DWORD%, 6
HKR, ALL\1\Port\4\Dtd\1 , VertBlank, %REG_DWORD%, 38
HKR, ALL\1\Port\4\Dtd\1 , Flags, %REG_DWORD%, 0x20000
HKR, ALL\1\Port\4\Attr , 27, %REG_DWORD%, 0
HKR, ALL\1\Port\4\Attr , 26, %REG_DWORD%, 18
HKR, ALL\1\Port\2\General , name, %REG_SZ%, "SDVOB"
HKR, ALL\1\Port\2\General , Rotation, %REG_DWORD%, 0
HKR, ALL\1\Port\2\General , Edid, %REG_DWORD%, 1
HKR, ALL\1\Port\2\General , EdidAvail, %REG_DWORD%, 3
HKR, ALL\1\Port\2\General , EdidNotAvail, %REG_DWORD%, 4

;===============================================================================
[igd_SoftwareDeviceSettings_tnc]
HKR,, UserModeDriverName,    %REG_MULTI_SZ%, igdumd32.dll
HKR,, InstalledDisplayDrivers,    %REG_MULTI_SZ%, igdumd32
HKR,, UserModeDriverGUID,  %REG_SZ%,{"A37D3D79-C3DB-4270-A0D6-72F8AB8F511D"}
HKLM, "SYSTEM\CurrentControlSet\Control\GraphicsDrivers",  UseXPModel,
%REG_DWORD%,  0
HKR,, OpenGLDriverName,            %REG_MULTI_SZ%, igdogl32.dll
HKR,, OpenGLVersion,               %REG_DWORD%,    1
HKR,, OpenGLFlags,                 %REG_DWORD%,    1

HKR,, MSDKLib,            %REG_MULTI_SZ%, libmfxhw32.dll

HKR,, PcfVersion,    %REG_DWORD%, 0x0700

HKR,, ConfigId, %REG_DWORD%, 1

HKR, ALL\1 , name, %REG_SZ%, "Atom_E6xx_13X7"
HKR, ALL\1\General , DisplayConfig, %REG_DWORD%, 1
HKR, ALL\1\General , PortOrder, %REG_SZ%, "42000"
HKR, ALL\1\Port\4\General , name, %REG_SZ%, "LVDS13x7"
HKR, ALL\1\Port\4\General , Rotation, %REG_DWORD%, 0
HKR, ALL\1\Port\4\General , Edid, %REG_DWORD%, 1
HKR, ALL\1\Port\4\General , EdidAvail, %REG_DWORD%, 3
HKR, ALL\1\Port\4\General , EdidNotAvail, %REG_DWORD%, 4
HKR, ALL\1\Port\4\FpInfo , bkltmethod, %REG_DWORD%, 1
HKR, ALL\1\Port\4\FpInfo , BkltT1, %REG_DWORD%, 60
HKR, ALL\1\Port\4\FpInfo , BkltT2, %REG_DWORD%, 200
HKR, ALL\1\Port\4\FpInfo , BkltT3, %REG_DWORD%, 200
HKR, ALL\1\Port\4\FpInfo , BkltT4, %REG_DWORD%, 50
HKR, ALL\1\Port\4\FpInfo , BkltT5, %REG_DWORD%, 400
HKR, ALL\1\Port\4\Dtd\1 , PixelClock, %REG_DWORD%, 72300
HKR, ALL\1\Port\4\Dtd\1 , HorzActive, %REG_DWORD%, 1366
HKR, ALL\1\Port\4\Dtd\1 , HorzSync, %REG_DWORD%, 48
HKR, ALL\1\Port\4\Dtd\1 , HorzSyncPulse, %REG_DWORD%, 32
HKR, ALL\1\Port\4\Dtd\1 , HorzBlank, %REG_DWORD%, 160
HKR, ALL\1\Port\4\Dtd\1 , VertActive, %REG_DWORD%, 768
HKR, ALL\1\Port\4\Dtd\1 , VertSync, %REG_DWORD%, 3
HKR, ALL\1\Port\4\Dtd\1 , VertSyncPulse, %REG_DWORD%, 5
HKR, ALL\1\Port\4\Dtd\1 , VertBlank, %REG_DWORD%, 22
HKR, ALL\1\Port\4\Dtd\1 , Flags, %REG_DWORD%, 0x20000
HKR, ALL\1\Port\4\Attr , 27, %REG_DWORD%, 0
HKR, ALL\1\Port\4\Attr , 26, %REG_DWORD%, 18
HKR, ALL\1\Port\4\Attr , 60, %REG_DWORD%, 1
HKR, ALL\1\Port\4\Attr , 70, %REG_DWORD%, 100
HKR, ALL\1\Port\4\Attr , 71, %REG_DWORD%, 20300
HKR, ALL\1\Port\2\General , name, %REG_SZ%, "SDVOB"
HKR, ALL\1\Port\2\General , Rotation, %REG_DWORD%, 0
HKR, ALL\1\Port\2\General , Edid, %REG_DWORD%, 1
HKR, ALL\1\Port\2\General , EdidAvail, %REG_DWORD%, 3
HKR, ALL\1\Port\2\General , EdidNotAvail, %REG_DWORD%, 4

;===============================================================================
```



```
;
; Source file information
;
[SourceDisksNames.x86]
1 = %DiskId%,,,""

[SourceDisksFiles]
igdkmd32.sys  = 1
igdumd32.dll = 1

igdsgl32.dll = 1
igdogl32.dll =1

libmfxhw32.dll = 1

igdkmd32.vp = 1
igd_XC.vp = 1
igd_XO.vp = 1
igd_XA.cpa = 1
igd_XA.vp = 1

hccutils.dll = 1
igfxsrvc.dll = 1
igfxsrvc.exe = 1
igfxpph.dll = 1
igfxcpl.cpl = 1
igfxcfg.exe = 1
igfxdo.dll = 1
igfxtray.exe = 1
hkcmd.exe = 1
igfxres.dll = 1
igfxress.dll = 1; Generic language resource file
IgfxExtps.dll = 1
IgfxExt.exe = 1

igfxrENU.lrc = 1

igfxressENU.lrc = 1

;=============================================================================
[CUI.AddReg]
;Add INTEL/CUI keys
HKLM,"Software\INTEL"
HKLM,%DisplayKey%
HKLM,%CUIDeviceIndependentKey%

; Device Independent registry location
HKCR,"CLSID\{280A8F40-E382-11D2-B561-00A0C92E6848}",,,%CUIDeviceIndependentKey%

; Add Diagnostic Pages with the rest of the pages
;fixme
HKLM,"SOFTWARE\Microsoft\Windows\CurrentVersion\Controls
Folder\Display\shellex\PropertySheetHandlers\igfxcui",,,"{3AB1675A-CCFF-11D2-8B20-
00A0C93CB1F4}"

; Store resource information under %CUIDeviceIndependentKey%
; Control panel resource
HKLM,"%CUIDeviceIndependentKey%\igfxcpl\resources","468",,%11%"\igfxcfg.exe"
; static pages resource
HKLM,"%CUIDeviceIndependentKey%\igfxpph\resources","468",,%11%"\igfxcfg.exe"
; cfg resource
HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","468",,%11%"\igfxcfg.exe"
HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","829",,""
; service resource
HKLM,"%CUIDeviceIndependentKey%\igfxsrvc\resources","468",,%11%"\igfxcfg.exe"
; tray resource
HKLM,"%CUIDeviceIndependentKey%\igfxtray\resources","468",,%11%"\igfxcfg.exe"
```

```
HKLM,"%CUIDeviceIndependentKey%\igfxtray\resources","467",,%11%"\igfxtray.exe"
HKLM,"%CUIDeviceIndependentKey%\igfxtray\TrayIcon","ShowTrayIcon",%REG_DWORD%,1
; hotkey resource
HKLM,"%CUIDeviceIndependentKey%\hkcmd\resources","468",,%11%"\igfxcfg.exe"
;static pages resource
HKLM,"%CUIDeviceIndependentKey%\igfxpph\resources","467",,%11%"\igfxtray.exe"

; Context menu handler entry.
HKCR, "Directory\Background\shellex\ContextMenuHandlers\igfxcui",,,"{3AB1675A-
CCFF-11D2-8B20-00A0C93CB1F4}"
;
; Registration of CUI dll's: These will not self-register through the have-disk
install.
; Does not register TypeLibs or Interfaces.
;
; igfxcfg.exe self registration entries
;
HKCR,"AppID\{3D62E9A1-D243-11D2-B561-00A0C92E6848}",,,"igfxcfg"
HKCR,"AppID\igfxcfg.EXE","AppID",,"{3D62E9A1-D243-11D2-B561-00A0C92E6848}"
HKCR,"CLSID\{A354BD60-4C0A-11d3-B561-00A0C92E6848}",,,"DataObject Class"
HKCR,"CLSID\{A354BD60-4C0A-11d3-B561-00A0C92E6848}","AppID",,"{3D62E9A1-D243-11D2-
B561-00A0C92E6848}"
HKCR,"CLSID\{A354BD60-4C0A-11d3-B561-
00A0C92E6848}\ProgID",,,"igfxcfg.DataObject.1"
HKCR,"CLSID\{A354BD60-4C0A-11d3-B561-
00A0C92E6848}\VersionIndependentProgID",,,"igfxcfg.DataObject"
HKCR,"CLSID\{A354BD60-4C0A-11d3-B561-
00A0C92E6848}\LocalServer32",,,%11%"\igfxcfg.exe"
HKCR,"CLSID\{EE2D6561-D63C-11D2-B561-00A0C92E6848}",,,"ShellExt Class"
HKCR,"CLSID\{EE2D6561-D63C-11D2-B561-00A0C92E6848}","AppID",,"{3D62E9A1-D243-11D2-
B561-00A0C92E6848}"
HKCR,"CLSID\{EE2D6561-D63C-11D2-B561-00A0C92E6848}\ProgID",,,"igfxcfg.ShellExt.1"
HKCR,"CLSID\{EE2D6561-D63C-11D2-B561-
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B126EE858CD8}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"

HKLM,"SOFTWARE\Classes\Interface\{3473E05A-3317-4DF5-9098-
E5387C94D1B0}",,,"ICUIExternalDual"
HKLM,"SOFTWARE\Classes\Interface\{3473E05A-3317-4DF5-9098-
E5387C94D1B0}\NumMethods",,,"7"
HKLM,"SOFTWARE\Classes\Interface\{3473E05A-3317-4DF5-9098-
E5387C94D1B0}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"

HKLM,"SOFTWARE\Classes\Interface\{5DC5B31E-0C28-4679-B8D8-
32CF2F9BACED}",,,"ICUIExternal4"
HKLM,"SOFTWARE\Classes\Interface\{5DC5B31E-0C28-4679-B8D8-
32CF2F9BACED}\NumMethods",,,"20"
HKLM,"SOFTWARE\Classes\Interface\{5DC5B31E-0C28-4679-B8D8-
32CF2F9BACED}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"
```

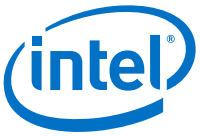

```
HKLM,"SOFTWARE\Classes\Interface\{70F8C65F-06AA-443B-9E6B-
7C73808F07E5}",,,"ICUIExternal3"
HKLM,"SOFTWARE\Classes\Interface\{70F8C65F-06AA-443B-9E6B-
7C73808F07E5}\NumMethods",,,"13"
HKLM,"SOFTWARE\Classes\Interface\{70F8C65F-06AA-443B-9E6B-
7C73808F07E5}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"

HKLM,"SOFTWARE\Classes\Interface\{A05C525D-B4CB-4108-BFF7-
1ACF1A14F00A}",,,"ICUIExternal5"
HKLM,"SOFTWARE\Classes\Interface\{A05C525D-B4CB-4108-BFF7-
1ACF1A14F00A}\NumMethods",,,"23"
HKLM,"SOFTWARE\Classes\Interface\{A05C525D-B4CB-4108-BFF7-
1ACF1A14F00A}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"

HKLM,"SOFTWARE\Classes\Interface\{AFB6489F-4515-44AA-8DF7-
ED28EA46283C}",,,"ICUIExternal6"
HKLM,"SOFTWARE\Classes\Interface\{AFB6489F-4515-44AA-8DF7-
ED28EA46283C}\NumMethods",,,"36"
HKLM,"SOFTWARE\Classes\Interface\{AFB6489F-4515-44AA-8DF7-
ED28EA46283C}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"

HKLM,"SOFTWARE\Classes\Interface\{F932C038-6484-45CA-8FA1-
7C8C279F7AEE}",,,"ICUIExternal8"
HKLM,"SOFTWARE\Classes\Interface\{F932C038-6484-45CA-8FA1-
7C8C279F7AEE}\NumMethods",,,"38"
HKLM,"SOFTWARE\Classes\Interface\{F932C038-6484-45CA-8FA1-
7C8C279F7AEE}\ProxyStubClsid32",,,"{5DC5B31E-0C28-4679-B8D8-32CF2F9BACED}"


;
; igfxtray.exe execution on startup
;
HKLM,Software\Microsoft\Windows\CurrentVersion\Run,IgfxTray,,%11%"\igfxtray.exe"
HKLM,Software\Microsoft\Windows\CurrentVersion\Run,HotKeysCmds,,%11%"\hkcmd.exe"
HKLM,Software\Microsoft\Windows\CurrentVersion\Run,IgfxExt,,%11%"\IgfxExt.exe /
RegServer"
;
;
; Entries for receiving winlogon unlock event
;

HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","4519",,""
;zoom
HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","4515",,""
;opengl 3d
HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","4518",,""
; ??
HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","4517",,""
;Dual Frequency Power Settings
HKLM,"%CUIDeviceIndependentKey%\igfxcfg\resources","4660",,""



;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
[Strings]
;
; Non-Localizable Strings
;
REG_SZ         = 0x00000000
REG_MULTI_SZ   = 0x00010000
REG_DWORD      = 0x00010001
SERVICEROOT    = "System\CurrentControlSet\Services"

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;
; Localizable Strings
;
```

```
DiskId          = "Intel(R) Embedded Media and Graphics Driver"
Intel           = "Intel(R)"
i900G0="US15 Embedded Media and Graphics Controller"
iTNC0="Atom (TM) E6xx Embedded Media and Graphics Controller"

;=============================================================================
;
; CUI Strings
;
CUIDeviceIndependentKey="Software\Intel\Display\igfxcui"
DisplayKey="Software\Intel\Display"

;=============================================================================
[CUISDK_Registration]
11,,IgfxExt.exe,1

;
; Do not modify or copy the following line
; set SIGNING_KEY_VERSION=1
;
```

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Appendix E Using the AMI* Video BIOS Utility

E.1 Introduction

The AMI* Video BIOS Utility (AVBU*) is a command line utility that can extract, replace, insert, and delete PCI video option ROM modules from a ROM image file. This utility is used in conjunction with the Intel® Embedded Media and Graphics Driver (Intel® EMGD) CED utility. CED can be used to generate a customized video BIOS (VBIOS) ROM file that meets your specific display settings. AVBU can then be used to merge the VBIOS ROM image with the hardware platform system BIOS ROM image.

This utility is provided by American Megatrends Incorporated* (http://www.ami.com), and is designed to work only on the specific hardware platform listed below. For other platforms, please contact your hardware platform supplier. To obtain a copy of this utility, please visit http://www.ami.com/crownbayavbu/ and register for your copy free of charge.

E.2 Getting Started with the AMI Utility

1. To obtain the AMI utility, fill out the registration form at
   http://www.ami.com/crownbayavbu/
   After submitting the form you will receive a confirmation e-mail and a link to a license agreement or a phone call to verify your information.
2. Using the link provided in the e-mail, download the utility.
3. Expand the utility with the password provided from the download page.
   You will have an `AVBU.exe` utility and an AVBU Users Guide from the expansion.
4. Use the AVBU utility to update or merge your EMGD VBIOS with your AMI system BIOS. Use the 'replace' (/r) command. This is an example replace command for Crown Bay:
   AVBU OABTN019.ROM /r vga.bin 8086 4108 /o updated.rom

E.3 Supported Hardware Platforms

Currently the utility exclusively supports the Intel® Atom™ Processor E660 with Intel® Platform Controller Hub EG20T Development Kit.

E.4 Scope

The AVBU command line utility uses an internal table to control whether an option ROM can be added or removed from the image, depending on its Firmware ID, Firmware GUID, and the vendor and device IDs of the module.

This version of AVBU is designed to work specifically with the Intel® Atom™ Processor E660 with Intel® Platform Controller Hub EG20T Development Kit; it will not function on other platforms.

E.5 Features

- Filtered access: an internal table controls access to option ROM modules based on the identity of the BIOS and the module vendor and device identifiers. If there is no table match, the program issues the error message: “Access denied”
- Extract or copy a video option ROM
- Insert or Replace existing video option ROM
- Delete video option ROM

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